APPENDIX – M

MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)

Revised Syllabus for

Master of Computer Applications (MCA)
(CBCS - Semester Pattern)
This will be effective from the academic year 2016-17

REGULATIONS :

1. Course Objective:

To prepare the students to manage the software components in a computer independently and to be a Programmer/Project Leader. To motivate the students to take up Industrial Research in Computer Application and other streams.

2. Eligibility for Admission:

Admission Criteria as fixed by the AICTE.

3. Duration of the Course:

The students shall undergo the prescribed course of study for a period of not less than three academic year (Six semesters).

4. Medium of Instruction : English
5. Subjects/ Structure of Course Study : See Appendix – PCA1
6. Scheme of Examinations/ Structure of Question Paper: : See Appendix - PCA2
7. Detailed Syllabus: See Appendix – PCA3
8. Eligibility for the Degree:

i) A Candidate shall be eligible for the award of the degree on completion of the prescribed course of study and passing all the prescribed external examinations.

ii) Attendance progress, internal examinations, conduct certificate from the Head of the Institution shall be required for taking the external examination.

iii) The passing minimum and the ranking are as per the existing rule of the Choice Based Credit System for the affiliated college of the University.

Appendix – PCA1
(Subject/Structure of Course Study)

Semester	Subjects						Total Hours	Total Credits
I	CS11(5) [4]	CS12(5) [5]	CS13(5) [5]	CS14(5) [5]	CS15(5) [3]	CS16(5) [3]	30	25
II	CS21(5) [4]	CS22(5) [5]	CS23(5) [5]	CS24(5) [5]	CS25(5) [3]	CS26(5) [3]	30	25
III	CS31(5) [4]	CS32(5) [5]	CS33(5) [5]	CS34(5) [3]	CS35(6) [3]	NME(4) [4]	30	24
IV	CS41(5) [5]	CS42(5) [5]	CS43(5) [5]	CS44(5) [3]	CS45(5) [3]	ES1(5) [5]	30	26
V	CS51(5) [5]	CS52(5) [5]	CS53(5) [5]	CS54(5) [3]	CS55(5) [3]	ES2(5) [5]	30	26
VI	CP-Project Work & Viva Voce							14
	Total							140

Abbreviations:

( )	–	Number of Hours	[ ]	–	Number of Credits
CS	-	Core Subject	NME	-	Non Major Elective
ES	-	Elective Subject			

I SEMESTER

Subject No.	Title	Hours	Credits	Internal Marks	External Marks
CS11	Mathematical Foundations	5	4	25	75
CS12	Digital Principles and Computer Organization	5	5	25	75
CS13	Programming in C	5	5	25	75
CS14	Database Management Systems(DBMS)	5	5	25	75
CS15	**Lab1:** C Programming	5	3	40	60
CS16	**Lab 2:** DBMS	5	3	40	60
	Total	30	25		

II SEMESTER

Subject No.	Title	Hours	Credits	Internal Marks	External Marks
CS21	Object Oriented Programming using C++	5	4	25	75
CS22	Data Structure and Algorithms	5	5	25	75
CS23	Operating Systems	5	5	25	75
CS24	Computer Graphics and Multimedia	5	5	25	75
CS25	**Lab3:** Data Structures and Algorithms using C++	5	3	40	60
CS26	**Lab 4:** Graphics and Multimedia	5	3	40	60
	Total	30	25		

III SEMESTER

Subject No.	Title	Hours	Credits	Internal Marks	External Marks
CS31	Optimization Techniques	5	4	25	75
CS32	Computer Networks	5	5	25	75
CS33	Java Programming	5	5	25	75
CS34	**Lab 5:** Java Programming	5	3	40	60
CS35	**Lab 6 :** Open Source Programming	5	3	40	60
NME	Data Analytics using Open Source tool	5	4	25	75
	Total	30	24		

IV SEMESTER

Subject No.	Title	Hours	Credits	Internal Marks	External Marks
CS41	Software Engineering	5	5	25	75
CS42	Data Warehousing and Data Mining	5	5	25	75
CS43	Network Programming	5	5	25	75
CS44	**Lab7:** Network Programming	5	3	40	60
CS45	**Lab 8:** Data Warehousing and Data Mining using Open Source Tools	5	3	40	60
ES1	Elective 1	5	5	25	75
	Total	30	26		

ES1.1 – Cloud Computing   ES1.2 – Distributed Systems

ES1.3 – Security in Computing   ES1.4 – Internet of Things

ES1.5 - Digital Image Processing

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V SEMESTER

Subject No.	Title	Hours	Credits	Internal Marks	External Marks
CS51	Mobile Computing	5	5	25	75
CS52	Web Application Development	5	5	25	75
CS53	Compiler Design	5	5	25	75
CS54	**Lab 9:** Mobile Computing	5	3	40	60
CS55	**Lab 10:** Web Application Development	5	3	40	60
ES2	Elective 2	5	5	25	75
	Total	30	26		

ES2.1 – Information Retrieval   ES2.2 – Soft Computing

ES2.3 – Big Data analytics   ES2.4 – Software Testing

ES2.5 - Wireless Sensor Networks

VI SEMESTER

Project & Viva Voce

(Industry / Institutional Based)

Subject No.	Title	Credits	Internal Marks	External Marks
CP	CP- Project Work and Viva Voce	14	40	60

Non-Major Elective Courses to be offered by the Department of Computer Applications to Other Departments

Appendix – PCA2
Scheme of Examination /Question Paper Pattern
Scheme of Evaluation

Theory Subjects:

Question Paper Pattern:

Time: 3 Hours	**Max. Marks: 75**

Part – A

Answer all the questions   (10*1=10)

Ten Questions, two questions from every UNIT: *Multiple Choice Questions*

Part – B

Answer all the questions   (5*7=35)

Five Questions, one question set from every UNIT: *Either ...Or... type*

Part – C

Answer any three questions   (3*10=30)

Five Questions, one question from every UNIT

The following list of parameters taken into account for the evaluation of the Practical examination and Project work.

For Practical Subjects:

Parameters:

i.	Aim, Procedure / Algorithm and Program:	15
ii.	Coding and Compilation :	10
iii.	Debugging :	15
iv.	Results :	10
v.	Viva:	10
	Total	**60**

Note: The External Examiner can fix other exercises also, other than those found in the list *(Syllabus)* in consultation with the Internal Examiner without violating the scope of the prescribed syllabus.

For Project Work:

Total Marks: 100 (Internal: 40 marks,   External: 60 Marks)

Parameters:

For Internal Marks (40):

Start-up Review	: 5 Marks
Design Review	: 7.5 Marks
Implementation and Validation Review	: 7.5 Marks
Final Review	: 10 Marks
Overall Performance	: 10 Marks

For External Marks (60):

Project Report	: 20 Marks
Project work, Demo & Presentation	: 30 Marks
Viva-Voce	: 10 Marks

Appendix – PCA3
(Detailed Syllabus)
CS11: MATHEMATICAL FOUNDATIONS
(5 Hours – 4 Credits)

UNIT I

Logic: Propositional Logic - Applications of Propositional Logic - Propositional Equivalences.- Predicates and Quantifiers - Nested Quantifiers - Rules of Inference .

UNIT II

Basics : Sets - Set Operations - Functions - Sequences and Summations - Cardinality of Sets - Matrices.

UNIT III
Number Theory: Divisibility and Modular Arithmetic - Integer Representations and Algorithms - Primes and Greatest Common Divisors Solving Congruences.- Applications of Congruences.

UNIT IV

Algebraic Systems : Binary Operation – Algebraic Systems – Semigroups and Moniod – Homomorphisms and isomorphisms of semigroups and moniods – Groups – Order of groups – subgroup of a group – cyclic groups.

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UNIT V

Graph Theory: Basic concepts – Matrix representation of graphs – shortest path problem – cut sets and cut vertices – Eulerian and Hamiltonian graphs – Networks – Planar graphs.

Text Books:

1. Discrete Mathematics and Its Applications, Kenneth H.Rosen, Tata McGraw Hill, Fourth Edition, 2002.
   UNIT I: Chapter 1.1 – 1.6
   UNIT II: Chapter 2.1 – 2.6
   UNIT III: Chapter 4.1 – 4.5
2. Discrete Mathematics, MK.Venkataraman, N.Sridharan, N.Chandrasekaran, The National Publishing Company 2000.
   UNTI IV Chapter 7 (7.1 to 7.4,7.6 to 7.10)
   UNIT V: Chapter 11(11.1,11.2,11.5,11.7 to 11.10)

Reference Books:

1. Discrete Mathematical Structures with applications to Computer Science, Tremblay and Manohar, McGraw Hill,1997.
2. 2 . Discrete Mathematics and its Application, A.Tamilarasi & A.M.Natarajan, , Khanna Publishers, 2nd Edition 2005.

CS12 : DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION
(5 Hours – 5 Credits)
UNIT I

Binary systems: Digital computers and digital systems-Binary numbers-Number Base Conversion- Octal and Hexadecimal numbers-Complements-Binary codes. **Boolean Algebra and logic gates:** Basic definitions- Axiomatic definition of Boolean algebra- Basic theorems and properties of Boolean algebra-Boolean functions- Canonical and standard forms-other logic operations- Digital logic gates-IC digital logic families.

UNIT II

Simplification of Boolean functions: The map method- Two-and Three- variable maps - Four – variable map- Don't care conditions. **Combinational logic:** Introduction- Design procedure- Adders- Subtractors. **Combinational logic with MSI and LSI:** Decoders – Multiplexers **Sequential logic: Introducation** Flip-Flops- Triggering Flip-flop.

UNIT III

Basic Structure of Computers: Computer types – Functional units – Basic operational concepts – Bus Structures – Software – Historical Perspective. **Machine Instructions and Programs:** Memory operations – Instructions and Instruction Sequencing – Addressing modes – Assembly Language – Basic Input/Output Operations.

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UNIT IV

Input/Output Organization: Accessing I/O devices- Interrupts- Direct Memory Access- Buses- Interface Circuits. **The Memory System:** Read only memories - Cache Memories.

UNIT V

Basic Processing Unit: Some fundamental concepts- Execution of a complete Instruction- Multiple Bus Organization-Hardwired Control- Micro programmed control. **Pipelining :** Basic Concepts – Data Hazards – Instruction Hazards.

TEXT BOOK:

1. Digital Logic and Computer Design – M.Morris Mano, Pearson Prentice Hall, Tenth impression, 2008.
   > Unit I: Chapter 1(1.1 to 1.4,1.6) and 2(2.1 to 2.8)
   > Unit II: Chapter 3,(3.1 to 3.4,3.8) 4 (4.1 to 4.4) , 5(5.5, 5.6) , 6(6.1 to 6.3)

2. Computer Organization- V.Carl Hamacher, Zvonko G.Vranesic, Safwat G.Zaky, The McGraw-Hill Companies, Fifth Edition, 2012.
   > Unit III: Chapter 1 (1.1 to 1.5,1.8) 2 (2.2 to 2.7)
   > Unit IV: Chapter 4(4.1 to 4.6 except 4.3) Chapter 5.3,5.5
   > Unit V : Chapter 7(7.1 to 7.5) Chapter 8.1 to 8.3

REFERENCE BOOKS:

1. Digital Principles and Applications- Donald.P.Leach ,Albert Paul Malvino,TMH,2001.
2. Computer Organization and Architecture-William Stallings PHI 2008.

CS13: PROGRAMMING IN C
(5 Hours – 5 Credits)

UNIT I

Introduction to C: Introduction – About ANSI C Standard – Overview of Compilers and Interpreters – Structure of C Program – Programming Rules – Executing the program.
The C Declarations: Introduction – The C Character Set – Delimiters – The C keywords – Identifiers – Constants – Variables – Rules for Defining variables – Data types – Declaring variables – Initializing variables – Type conversion – Constant and volatile variables.
Operators and Expressions: Introduction – Priority of operators and their clubbing – Comma nd conditional operator – Arithmetic operators – Relational operators – Logical operators – Bitwise operators.
Input and Output in C: Introduction - Formatted functions – Unformatted functions – Commonly used Library functions.

UNIT II

Decision Statements: Introduction – The if statement – The if else statement – Nested if-else statement – The break statement – The continue statement – The goto statement – The switch statement – Nested switch case – The switch case and nested ifs.
Loop Control Statements: Introduction – The for loop – Nested for loops – The while loop – The do-while loop – The do-while statement with while loop.

UNIT III

Arrays: Introduction – Array Initialization – Definition of Array – Characteristic of Array – One dimensional array – Predefined streams – Two dimensional array – Three or Multi dimensional arrays – The sscanf() and sprintf() functions.

Working with strings and standard functions: Introduction – Declaration and Initialization of string – Display of strings with different formats – String standard functions – Applications of Strings.

UNIT IV

Functions: Introduction – Definition of function – Declaration of function and function prototypes – The return statement – Types of functions – call by value and reference – Function returning more values – Function as an argument – Function with operators –Function and decision statements – Function and loop statements – Function with arrays and pointers – Recursion – Pointer to function.

Structure and Union: Introduction – Features of structures – Declaration and Initialization of structures – Structure within Structure – Array of structures – Pointer to structures – Structure and functions – typedef – Bit fields – Enumerated data type – Union – Calling BIOS and DOS services – Union of structures.

UNIT V

Pointers: Introduction – Features if pointers – Pointer declaration – Arithmetic operations with pointers – Pointers and Arrays – Pointers and Two dimensional arrays – Array of pointers – Pointers to pointers – Pointers and strings – void pointers.

Files: Introduction – Streams and File Types – Steps for file operations – File I/O – Structures read and write – other file function – Searching Errors in reading/writing files –Low level disk I/O – Command line arguments – Application of command line arguments – Environment Variables – I/O redirection.

Text Book:

Programming with ANSI and Turbo C by Ashok N.Kamthane, Seventh Impression, Pearson Education, 2008.

Unit I: Chapter 1, 2, 3, 4
Unit II: Chapter 5, 6
Unit III: Chapter 7, 8
Unit IV: Chapter 10, 13
Unit V: Chapter 9, 14

Reference Books:

1. Let us C – Yaswant Kanetkar – BPB Publications, Tenth Edition, 2010.
2. Programming with C (Schaum's outline series), Gottfried, Tata McGraw Hill, Second Edition, 2006.
3. Programming in ANSI C, E. Balagurusamy, Third Edition, Tata McGraw Hill, Publishing Company, 2005.

CS14 : DATABASE MANAGEMENT SYSTEMS
(5 Hours – 5 Credits)

UNIT I

Introduction: Database System Applications-Purpose of Database Systems-View of Data-Database languages-Relational Databases-Database Design-Object –Based and Semistructued Databases-Data Storage and Querying -Transaction Management-Data Mining and Information Retrieval – Specialty Databases and Analysis- Database Users and Administrators -History of Database Systems.

Introduction to Relational Model: Structure of Relational Databases- Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relation Operations.

UNIT II

Introduction to SQL: Overview of the SQL Query Language – SQL Data Definiton - Basic Structure of SQL Queries – Additional Basic Operations - Set Operations – Null values - Aggregate Functions - Nested Sub queries - Modification of the Database.

Formal Relational Query Languages: The Relational Algebra - The Tuple Relational Calculus-The Domain Relational Calculus..

UNIT III

Database design and the E-R Model: Overview of the Design Process-The Entity -Relationship Model - Constraints – Removing Redundant Attributes in Entity Sets - Entity-Relationship Diagrams – Reduction in Relational Schemas - Entity–Relationship Design Issues - Extended E-R Features.

Normalization of Database Tables: Database tables and normalization-The need for normalization-The normalization process-Conversion to First Normal From(1NF)- Conversion to Second Normal From(2NF)- Conversion to Third Normal From(3NF)-Improving the design-Surrogate key considerations-Higher Normal Form-The Boyce-Codd Normal Form(BCNF)-Fourth Normal Form(4NF)-Normalization and Database Design-Denormalization.

UNIT IV

Application Design and Development: Application Programs and User Interfaces – Web Fundamentals - Servlets and JSP – Application Architectures – Rapid Application Development - Application Performance -Application Security.

Storage and File Structure: Overview of Physical Storage Media-Magnetic Disks- RAID-Tertiary Storage – File Organization-Organization of Records in Files-Data-Dictionary Storage. **Indexing and Hashing:** Basic Concepts-Ordered Indices-B+ Tree Index File- B Tree Index File-Static Hashing-Dynamic Hashing-Comparison of Ordered Indexing and Hashing-Bitmap Indices - Index Definition in SQL.

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UNIT V

Transactions: Transaction Concept-Transaction State-Implementation of Atomicity and Durability-Concurrent Execution-Serializability – Transaction Isolation and Atomicity – Transaction Isolation Levels – Implementation of Isolation levels.

Concurrency Control: Lock -Based Protocols - Deadlock Handling - Multiple Granularity - Timestamp Based Protocols-Validation Based Protocols.

Recovery Systems: Failure Classification-Storage structure-Recovery and Atomicity-Remote Backup Systems.

Text Book:

1. Database System Concepts , Abraham Silberschatz ,Henry F.Korth,S.Sudarsan, Fifth Edition, McGraw-Hill International Edition, 2013.

> Unit I - Chapter 1, 2
> Unit II - Chapter 3, 6
> Unit III - Chapter 7(7.1 to 7.8)
> Unit IV - Chapter 9 , Chapter 10 Chapter 11
> Unit V - Chapter 14 Chapter 15 (15.1 to 15.5) Chapter 16 (16.1 to 16.3, 16.9)

2. Database System : Design Implementation & Management, Peter Rob, Carlos Coronel, Publishing by Cengage Learning, First Edition 2008. **Unit III - Chapter 5**

Reference Book:

Database Management Systems, Alexis Leon and Mathews Leon, Leon Vikas Publishing, Chennai 2002.

CS15: LAB 1: PROGRAMMING IN C
(5 Hours – 3 Credits)

1) The distance between two cities (in KM) is input through the keyboard. Write a program to convert and print this distance in meters, feet, inches and centimeters.

2) Write a program to display Floyd's triangle.

3) If a five digit number is input through the keyboard, write a program to print a new number by adding one to each of its digits.
For example, if the number that is input is 12391, then the output should be displayed as 23402.

4) Write a program to check a given number Armstrong or not.

5) Write a program to generate Fibonacci series up to n terms.

6) Write a program to find the grade of the student using switch.

7) Write a program to evaluate sin, cos series using function.

8) Write a program to find the factorial of a given number using Recursion.

9) Write a program to swap two numbers using Pointers.

10) Write a function (using a pointer parameter) that reverses the elements of a given array.

11) Write a menu driven program to find the following in matrix:

i) Transpose,
ii) Determinant,
iii) Multiplication.

12) Write a menu driven program for string manipulation.
13) Write a program to count all vowels from a given sentence.
14) Write a program to create structure for automobile company information.
15) Write a program to sort records in a file
16) Write a program to copy a file.
17) Write a program using command line arguments to check a given string is palindrome or not.

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

CS16 : LAB 2: DBMS
(5 Hours – 3 Credits)

1. Creation of base tables and views.
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries and JOIN
3. Data Control Commands
4. High level language extensions – PL/SQL. Or Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity.
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers
8. Working with Forms, Menus and Report Writers for a application project in any domain
9. Front-end tools – Visual Basic.

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

CS21: OBJECT ORIENTED PROGRAMMING USING C++
(5 Hours – 4 Credits)

UNIT I

Introduction to C++ - Input and Output in C++ : Introduction – Streams in C++ - Pre-defined Streams – Stream Classes – Formatted and Unformatted Data – Unformatted Console I/O Operations – Member Functions of istream Class – Formatted Console I/O Operations – BIT Fields – Flags without BIT Field – Manipulators – C++ Declarations.

UNIT II

Classes and Objects: Introduction – Structures in C++ - Classes in C++ - Declaring Objects – The public, private, protected keywords – Defining Member Functions and its characteristics-Outside member function inline – Rules for inline function – data hiding and encapsulation – classes, objects and memory – Static Member Variables and Function – Static Object – Array of

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Objects – Objects as Function Arguments – Friend Functions – Recursive Member Function – Overloading Member Functions – Overloading main() Function.

Constructors and Destructors : Introduction – Constructors and Destructors and its characteristics – Constructors with Arguments – Overloading Constructors – Constructors with Default Arguments – Copy Constructors – Destructors – Calling Constructors and Destructors – Anonymous Objects – Private Constructors and Destructors – Dynamic Initialization of Constructors - Recursive Constructors.

UNIT III

Operator Overloading and Type Conversion : Introduction – The Keyword Operator – Overloading Unary Operations – Operator Return Type – Constraint on Increment and Decrement Operators – Overloading Binary Operators – Overloading with friend Function – Type Conversion – Rules for Overloading Operators – One Argument Constructor and Operators Function – Overloading Stream Operators.

Inheritance: Introduction – Access Specifiers and Simple Inheritance – Protected Data with Private Inheritance – Types of Inheritances – Single Inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Multipath Inheritance – Virtual Base Classes – Constructors, Destructors and Inheritance - Object as a Class Member – Abstract Classes – Qualifier Classes and Inheritance – Common Constructor – Pointers and Inheritance – Overloading Member Function – Advantages of Inheritance – Disadvantages of Inheritance.

UNIT IV

Binding, Polymorphism and Virtual Functions : Introduction – Binding in C++ - Pointer to Derived Class Objects – Virtual Functions – Rules for Virtual Functions – Array of Pointers – Pure Virtual Functions – Abstract Classes – Working of Virtual Functions – Virtual Functions in Derived Classes – Object Slicing – Constructors and Virtual Functions – Virtual Destructors – Destructors and Virtual Functions.

Application with Files : Introduction – File Stream Classes – Steps of File Operations – Checking for Errors – Finding End of File – File Opening Modes – File Pointers and Manipulators – Binary and ASCII Files.

UNIT V

Generic Programming with Templates : Introduction – Need of Template – Class and Function Template – Overloading of Templates Functions – Recursion with Template Function – Class Template with overloaded operators – Class Template and Inheritance – Bubble Sort using Function Template – Difference between Template and Macros.

Exception Handling : Introduction – Principles of Exception Handling – The keyword Try, Catch and throw – Exception Handling Mechanism – Multiple Catch Statements – Catching Multiple Exceptions – Re throwing Exceptions – Exception in Constructors and Destructors – Exceptions and Operator Overloading – Exception and Inheritance – Class Template with Exception Handling.

Text Book:

Ashok N Kamthane, Object Oriented Programming ANSI and Turbo C++, 1st edition, Pearson Education, 2006.

Unit I: Chapters 1, 2, 3
Unit II: Chapters 6, 7
Unit III : Chapters 8, 9
Unit IV : Chapters 12, 13
Unit V: Chapters 14, 15

Reference Books :

1. Object Oriented Programming with C++, Balaguruswamy, Third Edition, Tata McGraw-Hill, New Delhi 2008.
2. Object oriented Programming with C++, G.Sheshasaayee, Ananthi Sheshasaayee, Margham Publications Second Edition, 2004.
3. Let us C++, Yashwant Kanetkar, BPB Publications, Tenth edition, 2010.

CS22: DATA STRUCTURES AND ALGORITHMS
(5 Hours – 5 Credits)

UNIT I

Abstract Data Types (ADT) – The List ADT – Vector and list in the STL – Implementation of vector – Implementation of list – The Stack of ADT – The Queue ADT.

UNIT II

Trees: Preliminaries – Binary Trees – The search tree ADT – Binary Search Trees – AVL Trees - Splay Trees – Tree Traversals – B-Trees – Sets and Maps in the Standard Library.

UNIT III

Hash Function – Separate Chaining - Hash tables without Linked lists – Rehashing – Hash Tables in the Standard Library - Hash Tables with Worst-Case Access – Universal Hashing – Extendible Hashing.**BALANCED SEARCH TREES, SORTING AND INDEXING :** AVL trees –B-Trees - Sorting – Bubble sort - Quick Sort - Insertion Sort – Heap sort – Hashing - Hashing functions - Collision Resolution Techniques - Separate chaining - Open addressing – Multiple hashing – Insertion Sort - - A Lower Bound for Simple Sorting Algorithms – Shell sort – Heap sort - Quick sort - Decision trees – Adversary Lower bounds – External Sorting.

UNIT IV

GRAPHS: Definitions – Representation of graph - Topological sort – shortest-path algorithms – Network flow problems - Minimum spanning tree – Applications of Depth-First Search – Introduction to NP completeness.

UNIT V

ALGORITHM DESIGN AND ANALYSIS: Greedy Algorithms - Divide and Conquer – Dynamic Programming – Randomized Algorithms - Backtracking Algorithms

Text Book:

Data Structures and Algorithm Analysis in C++,M. A. Weiss,, Pearson Education Asia, 2013.

Unit I: Chapter 3p
Unit II: Chapter 4
Unit III: Chapter 5,7
Unit IV: Chapter 9
Unit V: Chapter 10

Reference Books:

1. Data Structures using C , Tanaenbaum A.S.,Langram Y. Augestein M.J, Pearson Education , 2004.
2. Introduction to the Design and Analysis of Algorithms ,Anany Levitin, Pearson Education 2003.
3. Fundamentals of Data structures in C++,E. Horowitz, S.Sahni and Dinesh Mehta, University Press, 2007.
4. Computer Algorithms/C++,E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition, University Press, 2007.

CS23: OPERATING SYSTEMS
(5 Hours – 5 Credits)

UNIT I

INTRODUCTION: What is an Operating System? - Types of operating systems – Computer System Structures - Operating systems structures :Systems components operating systems services-System calls - Systems programs - **Processes:** Process concept- process scheduling-Operation on processes - Co-operating processes - Inter process communications - **CPU Scheduling:** Scheduling criteria - Scheduling algorithms - Multiple-processor Scheduling.

UNIT II

PROCESS SYNCHRONIZATION: Process Synchronization – Critical Section problem – Semaphores - Classical problems of synchronization - Critical regions – Monitors – **Deadlocks:** Deadlock Characterization- Deadlock handling-Deadlock Prevention - Deadlock avoidance-Deadlock Detection-Deadlock Recovery - Threads-Multithreading Models.

UNIT III

MEMORY MANAGEMENT : Memory Management – Swapping - Contiguous Memory allocation – Paging – Segmentation – Virtual Memory - Demand paging - Page Replacement-Thrashing.

UNIT IV

DISK SCHEDULING AND DISTRIBUTED SYSTEMS: Disk Structures-Disk Scheduling-File Systems Interface-File concepts-Access methods-Directory Structures-File System Implementation-File Systems structures-Directory Implementation-Allocation Methods-Free

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Space management-Distributed File systems-Naming and Transparency-Remote File Accesses-Stateful Versus Stateless Service-File replication.

UNIT V
CASE STUDIES: Linux System-design Principles- process management-File Systems-Windows Vista-Systems Structures-Process management-memory management-Android OS-Virtual machine OS.

Text Book:

Operating Systems Concepts, Abraham Silberschalz Peter B Galvin, G.Gagne, Seventh Edition, AddisionWesley Publishing Co.,2010.

Unit I: Chapter 1,2,3,4
Unit II: Chapter 5,6,7,8
Unit III: Chapter 9,10
Unit IV: Chapter 14,15,16
Unit V: Chapter 20,21

Reference Books:

1. Modern operating Systems Andrew S.Tanenbaum, Third Edition, PHI Learning Pvt.Ltd., 2008.
2. Operating Systems: Internals and Design Principles William Stallings, Seventh Edition, Prentice Hall, 2011.
3. Operating Systems H M Deital, P J Deital and D R Choffnes, ,3rd edition, Pearson Education,2011.
4. Operating Systems: A Concept-based Approach ,D M Dhamdhere, Second Edition, Tata McGraw-Hill Education, 2007.

CS24: COMPUTER GRAPHICS AND MULTIMEDIA
(5 Hours – 5 Credits)

UNIT I
Two –Dimensional Geometric Transformations : Basic Transformations – Matrix Representations – Composite Transformations – Other Transformations – Transformations Between Coordinate Systems.

UNIT II
Two –Dimensional Viewing : The Viewing Pipeline – Viewing Coordinate Reference Frame – Window –to- Viewport Coordinate Transformation – Two-Dimensional Viewing Functions – Clipping Operations – Point Clipping – Line Clipping – Polygon Clipping – Curve Clipping – Text Clipping – Exterior Clipping.

UNIT III

Three Dimensional Geometric and Modeling Transformations : Translation-Rotation-scaling-other transformations Three Dimensional Viewing: Viewing pipeline – Viewing coordinates – Projections – Clipping – Three dimensional viewing functions.

UNIT IV

MULTIMEDIA:

Graphics: Elements of Graphics – Images and Color – Graphics Files and Application Formats – Obtaining Images for Multimedia use – Using Graphics in Multimedia Applications.
Digital Audio : Characteristics of sound and Digital Audio – Digital Audio Systems – MIDI – Audio File Formats – Using Audio in Multimedia Applications.

UNIT V

Digital Video and Animation: Background on Video – Characteristics of Digital Video – Digital Video Data Sizing – Video Capture and Playback systems – Computer Animation – Using Digital Video in Multimedia Applications.

Product design: Building blocks – classes of products – Content organizational strategies – story boarding.

Text books:

1. Computer Graphics in C Version Donald Hearn and M. Pauline Baker, Second Edition, Pearson Education,2012.
   - UNIT I : Chapter 5.1 – 5.5
   - UNIT II: Chapter 6.1 – 6.11
   - UNIT III: Chapter 11.1 – 11.4, 12.1 -12.3, 12.5,12.7
2. Multimedia Technology and Applications – David Hillman, Galgotia publications. Reprint 2012.
   - UNIT IV : Chapter 5,6
   - UNIT V: Chapter 7,8

Reference Books:

1. Advanced Graphics Programming Using OpenGL. ,Tom McReynolds – David Blythe, Elsevier, 2010
2. Multimedia Systems-Algorithms, Standards and Industry Practices ,Parag Havaldar and Gerard Medioni,, Course Technology, Cengage Learning, 2010.

CS25: LAB 3: DATA STRUCTURES AND ALGORITHMS USING C++
(5 Hours – 3 Credits)

1) Write a program to find the following in a one dimensional array:
   1. Find Maximum of N numbers.
   2. Find Minimum of N numbers.
   3. Find Summation of N numbers.
   4. Find Average of N numbers.

2) Write a program for calculating matrices operations:
  1. Addition
  2. Subtraction
  3. Multiplication
  4. Transpose of matrices
  5. Row wise, column wise and diagonal wise total.
  6. Symmetric Checking.
3) Write a program to do the following:
  1. String copy
  2. String concatenation
  3. String Comparison
  4. String reverse
  5. Find the length of the string
  6. String Conversion (Uppercase to Lowercase and Lowercase to Uppercase)
4) Write a program for manipulating single linked list.
5) Write a program to manipulate double linked list.
6) Write a program to manipulate circular double linked list.
7) Write a program for demonstrating any application of stack.
8) Write a program for demonstrating any application of queue.
9) Write a program to perform operations on binary tree.
10) Write a program for sorting by using the concept sorting by Insertion
11) Write a program for sorting by using the concept sorting by Selection
12) Write a program for sorting by using the concept sorting by Merging
13) Write a program for sorting by using the concept sorting by Exchange
14) Write a program for search by using Linear Search Techniques
15) Write a program for search by using Non-linear Search Techniques

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

CS26: LAB 4: GRAPHICS AND MULTIMEDIA
(5 Hours – 3 Credits)

Lab Work to be assigned in the following topics:

1. Creation of two dimensional objects and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations.

2. Clipping and windowing of a part of the created two dimensional object using any one of the clipping algorithm.

3. Creation of simple three dimensional objects like cube, cone and cylinder and applying simple transformations like Translation, Scaling, Rotation, Composite transformations, projections –Parallel, Perspective.

4. Finding out visible surfaces and removal of hidden surfaces in simple objects using object space and image space algorithms.

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5. Image enhancement, Image transformation from color to gray scale and vice versa, Image manipulation and Image optimization for web - Usage of editing tools, layers, filters, special effects and color modes. Creation of simple Gif animated images with textual illustrations, Image Compression.

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

CS31: OPTIMIZATION TECHNIQUES
(5 Hours – 4 Credits)

UNIT I
Introduction to O.R – Linear Programming Problem formulation – Graphical Method – Simplex Method – Big M-method – Duality – Dual Simplex Method.

UNIT II
Transportation problems – Vogel's approximation method – MODI method – Assignment Problem – Travelling salesman problem.

UNIT III
Game theory – Two persons zero sum game – game with and without saddle point – solution of 2 x 2 game – dominance – Graphical Method. Network scheduling – Critical path – CPM – PERT. PERT algorithm – Time cost optimization algorithm – resource allocation and scheduling.

UNIT IV
Inventory problems – Deterministic Model – EOQ Model with uniform demand – Production Inventory Model – Inventory model with planned shortages and inventory model with quantity discounts. Probalilistic inventory model – Inventory systems – Safety stock – reorder level – reorder point determination.

UNIT V
Queueing Theory – Poisson and Exponential distribution – Birth-Death process – Queues with combined arrivals and departures – Steady state measures – Specialised Poisson Queues including Multiple servers and / or finite waiting hall.

Text Book
Operations Research – Kanti Swarup, P.K. Gupta and Manmohan – Sultan Chand and Sons 2009.
Unit I: Chapter 1, 2, 3, 4.1 to 4.4, 5.1 to 5.3
Unit II: Chapter 10.1 to 10.13, 11.1 to 11.3 and 11.7
Unit III: Chapter 17.1 to 17.7, and 25
Unit IV: Chapter 19.1 to 19.12 and 20.1 to 20.5
Unit V: Chapter 21.1 to 21.9 (Upto Model V)

Reference Books :
1. Operations Research, H.A. Taha – Seventh Edition, Pearson Publications, 2007.
2. Operations Research – S.D. Sharma, KedarNath RamNath – 2005.

CS32: COMPUTER NETWORKS
(5 Hours – 5 Credits)

UNIT I

NETWORK FUNDAMENTALS: Uses of Networks – Categories of Networks – Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology – Transmission media.

UNIT II

DATA LINK LAYER: Data link control – Flow Control – Error Detection and Error Correction – MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth – Bridges.

UNIT III

NETWORK LAYER : Network layer – Switching concepts – Circuit switching – Packet switching –IP — Datagrams – IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP.

UNIT IV

TRANSPORT LAYER: Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. – Transport for Real Time Applications (RTP).

UNIT V

APPLICATIONS : Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA- web security –SSL.

Text Book:

Computer Networks, Andrew S.Tannenbaum David J. Wetherall, Fifth Edition , Pearson Education 2011. (Cover the mentioned topics)

Unit I: Chapter 1 & 2
Unit II: Chapter 3 & 4
Unit III: Chapter 5
Unit IV : Chapter 6
Unit V: Chapter 7 & 8

Reference Book:

1. Computer Networks – A systems Approach ,Larry L. Peterson & Bruce S. Davie, Fourth Edition, Harcourt Asia / Morgan Kaufmann, 2007.
2. Data and Computer Communications , William Stallings, Ninth Edition, Prentice Hall , 2011.
3. Data Communication and Networking ,Forouzan, Fifth Edition , TMH 2012.
4. Computer Networking: A Top-down Approach James F. Kurose, Keith W. Ross, Pearson Education, Limited, sixth edition,2012.
5. Data Communications and Networks ,Achyut S Godbole,Atul Hahate, second edition 2011.

CS33: JAVA PROGRAMMING
(5 Hours – 5 Credits)

UNIT I

The Genesis of Java: Java□s Lineage – The Creation of Java – Why Java is Important to the Internet – Java□s Magic – The Java Buzzwords – The Continuing Revolution. **An Overview of Java:** Object Oriented Programming – A First Simple Program – Two Control statements – Using Blocks of code – Lexical issues – The Java class libraries. **Data types, Variables and Arrays:** Java is strongly typed language – The simple types – Integers – Floating point types – Characters – Booleans – A closer look at Literals – Variables – Type conversion and Casting – Automatic type promotion in expressions – Arrays – A few words about strings.

UNIT II

Operators: Arithmetic operators – The Bitwise operators – Relational Operators – Boolean logical operators – The Assignment operator – The ? operator – Operator precedence – Using parentheses. **Control Statements:** Java□s selection statements – Iteration statements – Jump statements. **Introducing Classes:** Class fundamentals – Declaring Objects – Assigning Object reference variables – Introducing methods – Constructors – The this keyword – Garbage collection – The finalize( ) method. **A closer look at methods and classes:** Overloading methods – Using object as parameters – A closer look at argument passing – Returning objects – Recursion – Introducing access control – Understanding static – Introducing final – Introducing nested and inner classes – Using command line arguments.

UNIT III

Inheritance: Inheritance basics – Using super – Creating multilevel hierarchy – When constructors are called – Method overriding – Dynamic method dispatch – Using abstract classes – Using final with inheritance – The Object class. **Packages and Interfaces:** Packages – Access Protection – Importing packages – Interfaces. **Exception Handling:** Exception handling fundamentals – Exception types – Uncaught exceptions – Using try and catch – Multiple catch clauses – Nested try statements – throw – throws – finally – Java□s Built-in Exceptions – Creating your own Exception subclasses – Chained Exceptions – Using Exceptions.

UNIT IV

String Handling: The String constructors – String length – Special String operations – Character Extraction – String Comparison – Searching Strings – Modifying a String – Data Conversion using valueOf( ) – Changing the case of characters within a String – String Buffer. **Multithreaded programming:** The Java Thread model – The Main Thread – Creating a Thread – Creating Multiple Threads – Using isAlive( ) and join( ) – Thread priorities – Synchronization – Inter thread communication – Suspending, Resuming and Stopping Threads – Using Multithreading. **Input/Output: Exploring java.io:** The java I/O classes and interfaces – File – The Stream classes – The Byte streams –The Character streams.

UNIT V

The Applet Class: Applet basics – Applet Architecture – An Applet skeleton – Simple Applet Display methods – Requesting Repainting – Using the status window – The HTML APPLET tag – Passing parameters to Applets – getDocumentBase( ) and getCodeBase( ) – AppletContext and

showDocument( ) – The AudioClip Interface. **Event Handling:** Two Event Handling Mechanisms – The Delegation Event Model – Event Classes – Sources of Events – Event Listener Interfaces – Using the Delegation Event Model – Adapter Classes – Inner Classes. **Using AWT controls, Layout Managers and Menus:** Control fundamentals – Labels – Using Buttons – Applying Check Boxes – CheckboxGroup – Choice controls – Using Lists – Managing Scroll Bars – Using a TextField – Using a TextArea – Understanding Layout Managers – Menu Bars and Menus- Dialog Boxes – FileDialog – Handling Events by Extending AWT Components – Exploring the controls, menus and layout managers.

Text Book:

> The Complete Reference Java2 by Herbert Schildt, Tata McGraw Hill edition, Fifth edition, 2012.
>
> > Unit I - Chapter 1, 2, 3 (Pages 1 to 70)
> > Unit II - Chapter 4 (Pages73 to 150), 5 (Pages 99 to 126) , 6 (Pages 129 to 150), 7 (Pages 155 to 188)
> > Unit III - Chapter 8, 9, 10 (Pages 189 to 271)
> > Unit IV - Chapter 13 (Pages 347 to 367, 369 to 376), 11, 17 (Pages 537 to 572)
> > Unit V - Chapter 19 (Pages 627 to 651), 20, 22

Reference Books:

1. Java 2 Programming Black book, Steven Holzner et al , Dreamtech press, 2008.
2. Object Oriented Programming With Java, Rajkumar Buyya, S.Thamarai Selvi, Xingchen Chu, Tata McGraw Hill, 2009.
3. Object Oriented Programming in Java, Dr. G.T. Thampi, DreamTech Press, 2009.

CS34: LAB 5: JAVA PROGRAMMING
(5 Hours – 3 Credits)

1. Write a java program for sorting n numbers using command-line arguments
2. Write a java program to perform Matrix Operations.
3. Write a java program for method overloading.
4. Write a java program for method overriding.
5. Write a java program to using „SUPER☐.
6. Write a java program for pre-defined Exception.
7. Write a java program for a User-Defined Exception.
8. Write a java program using multilevel inheritance.
9. Write a java program using interface.
10. Write a java program using Multithreading.
11. Write a java program for Synchronization methods.
12. Write a java program for String Manipulation
13. Write a java program for Applet – Animation
14. Write a java program to illustrate file concept
15. Write a java program using packages.
16. Write a java program to demonstrate action listeners and event listeners.
17. Write a java program to demonstrate Adapter Classes. 18. Write a java program to use AWT components.

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

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NME: DATA ANALYTICS USING OPEN SOURCE TOOL
(5 Hours – 4 Credits)

UNIT I

Introducing R: What It Is and How to Get It : Getting the Hang of R - Running the R Program - Finding Your Way with R - Command Packages - **Starting Out: Becoming Familiar with R:** Some Simple Math - Reading and Getting Data into R - Viewing Named Objects - Types of Data Items - The Structure of Data Items - Examining Data Structure - Working with History Commands - Saving Your Work in R.

UNIT II

Starting Out: Working With Objects: Manipulating Objects - Viewing Objects within Objects - Constructing Data Objects - Forms of Data Objects: Testing and Converting. **Data: Descriptive Statistics and Tabulation** - Summary Commands - Summarizing Samples - Summary Tables.

UNIT III

Summary Commands for Tables - **Data: Distribution:** Looking at the Distribution of Data - Stem and Leaf Plot - **Simple Hypothesis Testing -** Using the Student's t-test - The Wilcoxon U-Test (Mann-Whitney) - Paired t- and U-Tests - Correlation and Covariance - Tests for Association.

UNIT IV

Introduction to Graphical Analysis: Box-whisker Plots - Basic Boxplots - Customizing Boxplots - Scatter Plots - Pairs Plots (Multiple Correlation Plots) - Line Charts - Line Charts Using - Copy Graphics to Other Applications - **Formula Notation and Complex Statistics -** Examples of Using Formula Syntax for Basic Tests - Formula Notation in Graphics - Analysis of Variance (ANOVA).

UNIT V

Manipulating Data and Extracting Components - Creating Data for Complex Analysis - Summarizing Data. **Regression (Li near Modeling)** Simple Linear Regression - Multiple Regression - Formulae and Linear Models - Plotting Linear Models and Curve Fitting - Summarizing Regression Models.

Text Book:

Beginning R: The Statistical Programming Language, Mark Gardener, WROX publishing, Kindle edition.

Reference Book:

R for Everyone Paperback, Jared P Lande, Addison Wesley, 2014.

CS41: SOFTWARE ENGINEERING
(5 Hours – 5 Credits)

UNIT I
Software and Software Engineering: The nature of software – Software Engineering – Software Myths. **Process Models:** A generic process model – Process assessment and improvement – Prescriptive process models – The unified process. **Agile Development:** What is Agility? – What is an Agile process? – Extreme programming.

UNIT II
Modeling: Principles that guide each framework activity – **Understanding Requirement:** Requirement engineering – Eliciting requirements – Negotiating requirements – Validating requirements. **Requirement Modeling: Scenarios, Information, and Analysis Classes:** Requirement Analysis – Scenario-based modeling – UML models that supplement the use case – Data modeling concepts – Class-based modeling.

UNIT III
Design Concepts: The design process - Design concepts – **Architectural design:** Software Architecture – Architecture design – **Componen-level design:** What is component? Designing class based components - **User Interface design:** User Interface analysis & design – Interface Analysis – Interface Design steps.

UNIT IV
Quality Management: What is quality? Software quality – Achieving software quality – **Software quality assurance;** Elements of software quality assurance – SQA tasks, Goals & metrics - Software reliability.

UNIT V
Software Testing strategies: A strategic approach to software testing – Testing strategies for conventional software – Test strategies for object- oriented software – Software testing. Software configuration Management-SCM.

Text book:

Software Engineering: A Practitioner Approach, Roger S. Pressman, Seventh edition, McGrawHill, 2015.

UNIT I : Chapters 1.1,1.3,1.6; 2.1,2.2,2.3,2.5;3.1,3.3,3.4
UNIT II : Chapters 4.3;,5.1,5.3,5.6,5.7; 6.1 to 6.5
UNIT III: Chapters 8.2,8.3;9.1,9.4;10.1,10.2;11,2,11,4
UNIT IV: Chapters 14.1,14.2,14.4; 16.2.16.3,16.6
UNIT V: Chapters 17.1,17.3,17.4,17.7;22.1

Reference Books:

1. Software Engineering Concepts ,Richard Fairley, Tata McGraw Hill Edition, 2008.
2. Software Engineering Fundamentals ,Ali Behforroz, Frederick J.Hudson, Oxford Indian Reprint, 2012.
3. Software Engineering Sommerville, Sixth Edition, AddisonWesley-Lohgman, 2004.
4. Software Engineering, Kassem A. Saleh, First Edition, J.Ross Publishing, 2009.
5. An Integrated approach to Software Engineering Pankaj Jalote, Third Edition, Springer Verlag,2005.
6. Web Engineering: A Practitioner's Approach Roger S. Pressman, David Lowe, Special Indian edition, McGrawHill, 2008.
7. Software Engineering Jibitesh Mishra, Ashok Mohanty, Pearson Education, First Edition, 2012.

CS42: DATA WAREHOUSING AND DATA MINING
(5 Hours – 5 Credits)

UNIT I

Data warehouse: The Building Blocks: Defining Features – Data Warehouse and Data Marts – Architectural Types – Overview of the Components – Metadata in the Data Warehouse. **Trends in Data Warehousing:** Continued Growth in Data Warehousing – Significant Trends – Emergence of Standards – Web enabled Data Warehouse.

UNIT II

Data Preparation: Preprocess the data- Data Cleaning- Data integration and Transformation- Data Reduction-Discretization and concept Hierarchy generation. Data mining Primitives, Languages and system Architectures: **Data mining Primitives**: Data mining task-Data mining query language-Designing GUI based on a data mining query language- Architectures of Data Mining.

UNIT III

Concepts Description: Characterization and comparison: Data Generalization and Summarization-based characterization –Analytical Characterization – Mining class comparisons-Mining descriptive and statistical measures in large databases- Concept description. Mining **Association Rules in Large Databases**: Association Rule mining- mining single-dimensional Boolean association rules from transactional databases- mining multilevel association rules from relational databases and data warehouses from association mining to correlation analysis –constraint-based association mining.

UNIT IV

Classification and Prediction: Issues Classification by decision tree induction- Bayesian Classification – Classification by Back propagation –Classification based on concepts from association rule mining- other classification methods -prediction- classifier accuracy.

UNIT V

Cluster Analysis: Type of data in cluster analysis-categorization of major clustering methods-partitioning methods- hierarchical methods- density-based methods-grid based methods based clustering methods-outlier.

Text Books:

1. Data Warehousing : Fundamentals of IT Professional, Paulraj Ponniah, 2nd Edition, Wiley Publication, 2013.
   UNIT I : Chapter 2,3

2. Data Mining Concepts and Techniques Jiawei Han and Micheline Kamber, Elsevier, Reprinted 2008.
   UNIT II: Chapter 2
   UNIT III: Chapter 5
   UNIT IV: Chapter 6
   UNIT V: Chapter 7

Reference Books:

1. Insight into Data mining Theory and Practice K.P. Soman, Shyam Diwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
2. Introduction to Data Mining with Case Studies, G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2007.
4. Modern Data Warehousing, Mining, and Visualization, MARAKAS, GEORGE M. Pearson Education, 2011.

CS43: NETWORK PROGRAMMING
(5 Hours – 5 Credits)

UNIT I

Introduction :UNIX Architecture - Logging In – Files and Directories – Input and Output – Programs and Processes – Error handling – User Identification – Signals – Time values – System Calls and Library functions – Standards and Implementation : UNIX Standardization – Implementations – Limits –Process Environment: main() – Process termination – Command line arguments – Environment list and variables. Process Control: Identifiers –fork () , vfork(), exit(), wait().

UNIT II

exec functions – Changing User IDs and Group IDs – System function – Process accounting – User identification – Process times. Process relationships: Terminal logins – Network logins – Process groups – Sessions – Controlling terminals – tcgetpgrp (), tcsetpgrp () – Job control – Shell execution of programs – Orphaned process groups. Daemon Processes: Characteristics – Coding rules.

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UNIT III

Socket Introduction: Socket address structure – Byte ordering and manipulation functions – Address conversions functions. Elementary TCP sockets: Introduction – socket, connect, bind, listen, accept, close functions – Concurrent server – Server host crashes, rebooting and shut down. I/O multiplexing: I/O models – select () – shutdown () – poll ().

UNIT IV

Socket options: getsocket () and setsocket () – Generic socket options – IP socket options (IPv4 and IPv6) – ICMP socket options – TCP socket options. Elementary UDP sockets: recvfrom and sendto functions – Lost datagrams – Verifying received response – Server not Running – connect () with UDP – Lack of flow control – Determining out going interface – TCP and UDP echo server using select () – DNS – gethostbyname() – gethostbyaddr () – getservbyname() and getservbyport ().

UNIT V

IPv4 and IPv6 interoperability – Routing sockets – Key management sockets : Reading and Writing – SADB – SA – Maintaining SAs – Broadcasting : Address – Unicast Vs Broadcast – Multicasting : Multicast Vs Broadcast – Multicasting on LAN – Multicasting on WAN – Threads: Creation and Termination – Raw sockets : Creation – Input – Output – ping program – trace route program.

Text Books:

1. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", Second Edition, Pearson Education, New Delhi, 2007.

   UNIT I: Chapters: 1, 2.2, 2.3, 2.5, 7.2 to 7.5, 7.9, 8.2 to 8.8
   UNIT II: Chapters: 8.10, 8.11, 8.13 to 8.16, 9.2 to 9.10, 13.2, 13.3

2. W.R.Stevens, B.Fenner, A.M.Rudoof, "UNIX Network Programming" Volume I, Third Edition, PHI Private Ltd, New Delhi, 2005.

   UNIT III: Chapters: 3.1 to 3.8, 4.1 to 4.6, 4.8, 5.14 to 5.16, 6.2, 6.3, 6.6, 6.10
   UNIT IV: Chapters: 7.1 to 7.2, 7.2, 7.5 to 7.9, 8.2, 8.7 to 8.9, 8.111, 8.13 to 8.15, 11.2 to 11.5
   UNIT V: Chapters: 12, 18, 19.2 to 19.5, 20.2, 20.3, 21.2 to 21.4, 26.2, 28.2 to 28.6

Reference Books:

1. Sumitabha Das, "Your UNIX the ultimate Guide", Tata McGraw Hill, 2002.
2. Ashok Arora, S. Bansal, "UNIX and C Programming" First edition, Firewall media, 2005.

CS44: LAB 7: NETWORK PROGRAMMING
(5 Hours – 3 Credits)

1. Implementation of File System Calls

2. Implementation of ICP Techniques – Pipe, Message Queue, Shared Memory

3. Socket Programming

a) TCP Sockets
b) UDP Sockets
c) Applications using Sockets
4. Simulation of Sliding Window Protocol
5. Simulation of Routing Protocols
6. RPC
7. Development of applications such as DNS / HTTP / E-mail / Multi-user chat

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

CS45: LAB 8: DATA WAREHOUSING AND DATA MINING USING OPEN SOURCE TOOLS
(5 Hours – 3 Credits)

Using weka tool

1. Demonstration of preprocessing on dataset student.arff

2. Demonstration of preprocessing on dataset labor.arff

3. Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm

4. Demonstration of Association rule process on dataset test.arff using apriori algorithm

5. Demonstration of classification rule process on dataset student.arff using j48 algorithm

6. Demonstration of classification rule process on dataset employee.arff using j48 algorithm

7. Demonstration of classification rule process on dataset employee.arff using id3 algorithm

8. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm

9. Demonstration of clustering rule process on dataset iris.arff using simple k-means

10. Demonstration of clustering rule process on dataset student.arff using simple kmeans

Note: The above are sample problems, Instructor can add more exercises on their requirements and to the technology

ES1.1 :CLOUD COMPUTING
(5 Hours – 5 Credits)

UNIT I

Understanding Cloud Computing : Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges. **Fundamental Concepts and Models** - 1 Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models.

UNIT II

Cloud-Enabling Technology - Broadband Networks and Internet Architecture - Data Center Technology - Virtualization Technology - Web Technology – Multitenant technology - Service Technology **Fundamental Cloud Security**: Basic Terms and Concepts - Threat Agents - Cloud Security Threats.

UNIT III

CLOUD COMPUTING ARCHITECTURE : Fundamental Cloud Architectures -Workload Distribution Architecture - Resource Pooling Architecture - Dynamic Scalability Architecture - Elastic Resource Capacity Architecture- Service Load Balancing Architecture
Cloud Bursting Architecture - Elastic Disk Provisioning - Redundant Storage Architecture **Advanced Cloud Architectures :** Hypervisor Clustering Architecture - Load Balanced Virtual Server Instances Architecture - Non-Disruptive Service Relocation Architecture - Zero Downtime Architecture - Cloud Balancing Architecture - Resource Reservation - Dynamic Failure Detection and Recovery - Bare-Metal Provisioning - Rapid Provisioning Architecture - Storage Workload Management Architecture

UNIT IV

WORKING WITH CLOUDS: Cloud Delivery Model Considerations: Cloud Delivery Models: The Cloud Provider - Cost Metrics and Pricing Models - Cloud Usage Cost Metrics - Cost Management Considerations -Service Quality Metrics and SLAs.

UNIT V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing.

Text Books:

1. Cloud Computing: Concepts, Technology & Architecture, Thomas Fri, Ricardo Puttini, Zaigham Mahmood, PHI, 2013.
   - UNIT I:Chapters 3 & 4
     UNIT II: Chapters 5 & 6
     UNIT III: Chapters 11 & 12
     UNIT IV: Chapters 14, 15, & 16

2. Cloud Computing: Implementation, Management, and Security ,John W. Rittinghouse,James F.Ransome, CRC Press 2009.
   UNIT V : 7,8

Reference Books:

1. Distributed and Cloud Computing From Parallel Processing to the Internet of Things, Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, Elsevier, 2012.

2. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski,(Wiley Series on Parallel and Distributed Computing), Wiley *Publishing* ©2011.

ES1.2 :DISTRIBUTED SYSTEMS
(5 Hours – 5 Credits)

UNIT I
INTRODUCTION : Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web. System Models : Physical Models – Architectural Models – Fundamental models

UNIT II
Inter process Communication - the API for internet protocols – External data representation and Multicast communication - Network virtualization: Overlay networks. Case study: MPI **Remote Invocation**: Introduction - Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI .**Indirect Communication**: Group communication - Publish-subscribe systems - Message queues - Shared memory approaches.

UNIT III
PEER TO PEER SERVICES: Introduction - Napster and its legacy - Peer-to-peer – Middleware - Routing overlays. Overlay case studies: Pastry, Tapestry- **Distributed File Systems**: Introduction - File service architecture – Andrew File system.

UNIT IV
TIME AND GLOBAL STATES: Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control - Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda.

UNIT V
PROCESS & RESOURCE MANAGEMENT: Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. **Resource Management:** Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

Text Books:

1. Distributed Systems Concepts and Design ,George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012

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Unit I: Chapter 1 & 2
Unit II: Chapter 4,5,6,
Unit III: Chapter 10,12
Unit IV: Chapter 14,15,16,17,18(mentioned part only)

2. Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
Unit V: Chapter 7 & 8

Reference Books:

1. Distributed Systems: Principles and Paradigms ,Tanenbaum A.S., Van Steen M., Pearson Education, 2007.
2. Distributed Computing, Principles and Applications ,Liu M.L., Pearson Education, 2004.
3. Distributed Algorithms ,Nancy A Lynch, Morgan Kaufman Publishers, USA, 2003.

ES1.3: SECURITY IN COMPUTING
(5 Hours – 5 Credits)

UNIT I
CRYPTOGRAPHY: Terminology and Background – Substitution Ciphers – Transpositions – Making Good Encryption Algorithms- Data Encryption Standard- AES Encryption Algorithm – Public Key Encryption – The Uses of Encryption.

UNIT II
PROGRAM SECURITY: Secure programs – Non-malicious Program Errors – Viruses and other Malicious Code – Targeted Malicious code – Controls Against Program Threat.
Protection in General-Purpose Operating System: Protected Objects and Methods of Address Protection – Control of Access to General Objects – File Protection Mechanisms - User Authentication

UNIT III
DATABASE AND DATA MINING SECURITY: Introduction to Databases – Security Requirements – Reliability and Integrity – Sensitive Data – Inference – Multilevel Databases – Proposals for Multilevel Security – Data Mining.

UNIT IV
SECURITY IN NETWORKS : Threats in networks – Network Security Controls – Firewalls – Intrusion Detection Systems – Secure e-mail.

UNIT V
ADMINISTERING SECURITY: Security Planning – Risk Analysis – Organizational Security Policies – Physical Security.

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Text Book:

1. Security in Computing ,Charles P. Pfleeger, Shari Lawrence Pfleeger, Pearson Education, 2011.
   - Unit I : Chapter 2
   - Unit II : Chapter 3 & 4
   - Unit III : Chapter 6
   - Unit IV : Chapter 7
   - Unit V: Chapter 8

Reference Books:

1. Management of Information Security , Michael Whitman, Herbert J. Mattord, "M, Third Edition, Course Technology, 2010.
2. Cryptography and Network Security : Principles and Practices ,William Stallings, Fifth Edition, Prentice Hall, 2010.

ES1.4 : INTERNET OF THINGS
(5 Hours – 5 Credits)

UNIT I
Introduction to Internet of Things: Introduction – Physical Design of IoT – Logical Design of IoT – IoT Enabling Technologies – IoT & Deployment Templates.

Domain Specific IoTs: Introduction – Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health & Lifestyle.

UNIT II
IoT and M2M : Introduction : M2M – Difference between IoT and M2M – SDN and NFV for IoT.

IoT System Management with NETCONF-YANG : Need for IoT Systems Management – Simple Network Management Protocol (SNMP) – Network Operator Requirements – NETCONF- YANG – IoT Systems Management with NETCONF_YANG.

UNIT III
IoT Platforms Design Methodology: Introduction – IoT Design Methodology – Case Study on IoT System for Weather Monitoring – Motivation for using Python.

IoT Systems – Logical Design using Python: Introduction – Installing Python – Python Data types & Data Structures – Control Flow – Functions – Modules – Packages – File Handling – Date/Time Operations – Classes – Python packages of Interest for IoT.

UNIT IV
IoT Physical Devices & Endpoints: What is an IoT Device – Exemplary Device: Raspberry Pi – About the Board – Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming Raspberry Pi with Python – Other IoT devices.

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IoT Physical Servers & Cloud Offerings : Introduction to Cloud Storage Models & Communication APIs – WAMP-AutoBahn for IoT – Xively Cloud for IoT – Python Web application Framework-Django – Designing a RESTful Web API – Amazon Web Services for IoT – Skynet IoT messaging platform.

UNIT V

Case Studies Illustrating IoT Design: Introduction – Home Automation – Cities – Environment – Agriculture – Productivity applications.

Data Analytics for IoT : Introduction – Apache Hadoop – Using Hadoop MapReduce for Batch Data Analysis – Apache Oozier – Apache Spark – Apache Storm – Using Apache Storm for Real-time Data Analysis.

Text Book:

Internet of Things , Arshdeep Bahga, Vijay Madisetti, Universities Press(INDIA) Private Ltd., 2015.

Unit I : Chapters 1 &2
Unit II: Chapters 3 & 4
Unit III: Chapters 5 & 6
Unit IV: Chapters 7 & 8
Unit V: Chapters 9 & 10

Reference Books:

1. Getting Started with the Internet of Things, Cuno Pfister, O'Relly, 2011.
2. Designing the Internet of Things,Adrian Mcewen, Hakin Cassimally, Willey, 2015.

ES1.5: DIGITAL IMAGE PROCESSING
(5 Hours – 5 Credits)

UNIT I:

Digital Image Processing: Origins of Digital Image Processing, Steps in Digital Image Processing, Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships between Pixels, Mathematical Tools used in Digital Image Processing.

UNIT II:

Image Transformation & Filters: Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filter, Sharpening Spatial Filters, Combining Spatial Enhancement, methods, Fuzzy techniques for Intensity Transformation and Spatial Filtering. Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transforms of Sampled Functions, The Discrete Fourier Transform (DFT), Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Sharpening using Frequency Domain Filters, Selective Filtering.

UNIT III:

Image Restoration, Reconstruction and Image Segmentation: Image Degradation/Restoration process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering. Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Functions, Inverse Filtering, Wiener Square Error Filtering, Constrained Least Square Filtering, Geometric Mean Filter, Image Reconstruction from Projections. Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation.

UNIT IV:

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Full Color Image Processing, Color Transformation, Smoothing and Sharpening, Image Segmentation Based on Color, Noise in Color Images. Wavelets and Multiresolution Processing: Multiresolution Expansion, Wavelet Transforms in One Dimension, The Fast Wavelet Transforms, Wavelet Transforms in Two Dimensions, Wavelet Packets. Image Compression: Fundamentals, Basic Compression Methods, Digital Image Watermarking.

UNIT V:

Morphological Image Processing: Erosion and Dilation, Opening and Closing, The Hit-Or-Miss Transformation, Basic Morphological Algorithms, Gray-Scale Morphology. Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

Text Book:

Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson Education, 2008.

UNIT I : Chapter 1 and 2
UNITII: Chapter 3 and 4
UNIT III: Chapter 5 and 10
UNIT 1V :Chapter 6 and 7
UNIT V : Chapter 9 and 12

Reference Books:

1. Digital Image Processing using MATLAB Rafael C. Gonzalez, Richard E. Woods,2nd Edition, Prentice Hall of India, 2002.

1. Fundamentals of Digital Image Processing A.Jain, Prentice Hall of India.

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CS51: MOBILE COMPUTING
(5 Hours – 5 Credits)

UNIT I
Introduction: Mobility Of Bits And Bytes – Wireless: The Beginning - Mobile Computing - Networks - Middleware And Gateways - Applications And Services - Standard Bodies. **Mobile computing Architecture:** Architecture For Mobile Computing - Three Tier Architecture. **Emerging Technologies:** Bluetooth - Radio Frequency Identification (RFID) – Wireless Broadband (Wimax) - Mobile IP - Internet Protocol Version 6(IPv6).

UNIT II
Global System For Mobile Communications (GSM): Global For Mobile Communications - GSM Architecture - GSM Entities - Call Routing In GSM. **Short message Service (SMS):** Mobile computing over SMS – Short Message service – Value added service through SMS.

General Packet Radio Service: Introduction – GPRS and Packet Data Network – GPRS network architecture - GPRS network operations - Data services in GPRS - Applications for GPRS – Limitations for GPRS – Billing and Charging in GPRS – Enhanced Data Rates for GSM Evolution(EDGE).

UNIT III
Wireless Application Protocol (WAP): Introduction – WAP – MMS – GPRS Application. - **CDMA AND 3G:** Third generation networks – Applications on 3G. **Wireless LAN:** Wireless LAN advantages - IEEE 802.11 standards - wireless LAN architecture.

UNIT IV
Client Programming: Introduction - Moving Beyond The Desktop - A Peek Under The Hood: Hardware Overview - Mobile Phones – Features of Mobile Phones – PDA – Design Constraints In Applications For Handle Held Devices. **Programming for the palm OS:** Palm OS Architecture. **Wireless devices with Symbian OS:** Symbian Os Architecture. **Wireless devices with windows CE:** Windows CE Architecture.

UNTI V
Multimedia: Networked Multimedia Application – Issues in Multimedia delivery over the Internet – Multimedia Delivery over the Internet – Multimedia Networking Protocols. **IP Multimedia Subsystem:** Introduction – IMS and its Evolution – Benefits from IMS – Architecture of IMS Networks – Protocols used in IMS – Building Blocks in IMS Networks. **Security issues in mobile computing:** Introduction-Information Security-Security Techniques and Algorithms-Security Protocols-Public Key Infrastructure.

Text Book:

Asoke.K.Talukder, Roopa.R.Yavagal, Hasan Ahmed. Mobile Computing Technology,Applications and Service Creation. Tata McGraw Hill Publishing Company. 2011. SecondEdition.

Unit I: Chapter 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.11, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5, 4.6

Unit II: Chapter 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 7.1 to 7.9

Unit III: Chapter 8.1 to 8.4, 9.6, 9.7, 10.2, 10.3, 10.4

Unit IV: Chapter 12.1 to 12.7, 13.3, 14.2, 16.3

Unit V: Chapter 18.6 to 18.9, 19.1 to 19.6, 20.1 to 20.5

Reference Books:

1. Mobile Computing Technology, Applications and Service Creation – Asoke.K.Talukder,Roopa.R.Yavagal – Tata McGraw Hill Publishing Company – 2009.

2. Mobile Computing Theory and Practice – Kumkum Garg – Pearson Education 2010.

3. Mobile computing – Sipra Dasbit, Biplab K. Sikdar – PHI Learning, Eastern Economy Edition,2009.

4. Principles Of Mobile Computing, Uwe Hansmann, Lothar Merk, Martin S. Nicklous,Thomas Stober – Second Edition – Springer (India) Private Limited – Seventh Indian Reprint2008.

CS52: WEB APPLICATION DEVELOPMENT
(5 Hours – 5 Credits)

UNIT I

J2EE Platform: Introduction -Enterprise Architecture Styles - J2EE Architecture - Containers - J2EE Technologies - Developing J2EE Applications - Naming and directory services - Using JNDI - JNDI Service providers - Java and LDAP - LDAP operations - Searching an LDAP server - Storing and retrieving java objects in LDAP - Application Servers - Implementing the J2EE Specifications - J2EE packaging and Deployment - J2EE packaging overview - Configuring J2EE packages.

UNIT II

STRUTS AND HIBERNATE: Struts Architecture - Struts classes - Action Forward, Action Form, Action Servlet, Action classes - Understanding struts - config.xml, Understanding Action Mappings, Struts flow with an example application, Struts Tiles Framework, Struts Validation Framework – Hibernate - Architecture of Hibernate - Downloading Hibernate - Exploring HQL - Understanding Hibernate O/R Mapping.

UNIT III

LAMP STACK: Overview of Lamp Stack - Features of Lamp Stack –Understanding Python Understanding LAMP and Its Effect on Web Development.

UNIT IV

.Net, C# : Introduction - .Net revolution - .Net framework and its architecture – CLR – What is Assembly – Components of Assembly – DLL hell and Assembly Versioning. Overview to C# - C # Compilation and Execution Process – C# Fundamentals (Data types, Operators,

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Programming constructs) – Inheritance –Sealed Classes – Interface - Overloading – OverRiding – Method Hiding – C# Property – Exception Handling.

UNIT V

ASP.NET AND SILVERLIGHT : ASP.Net- IIS - ASP.Net Page Life Cycle – ASP Vs ASP.Net - HTML Controls Vs Server side Controls – Validation Controls – Data binding in ASP.Net – Caching – Configuration in ASP.Net (web.config) – Session management – View State in ASP.Net – ASP.Net. Introduction - RIA – Silverlight – XAML – App.Xaml – XAP – How Silverlight application executes in a web browser.

Text Books:

1. Struts: The Complete Reference , James Holmes , 2nd Edition ,McGraw Hill Professional,2007.
   Unit I

2. Hibernate Quickly, Patrick Peak And Nick Heudecker, 2007
   Unit I & II

3. Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP, James Lee, BrentWare , AddisonWesley, Pearson 2009.
   Unit III

4. Programming C# , Jesse Liberty , 4th Edition, O'Reilly Media
   Unit IV

5. Pro ASP.NET 4 in C# Includes Silverlight 2, Mario Szpuszta, Matthew MacDonald, Apress, Third Edition.
   Unit V

Reference Books:

1. Professional Java Server Programming (J2EE 1.3 Edition), Subrahmanyam Allamaraju and Cedric Buest , Shroff Publishers & Distributors Pvt Ltd.
2. Professional Silverlight 4 Print Jason Beres, Bill Evjen, Devin Rader , December 2012
3. The Quick Python Book Vern Ceder , Second Edition, Manning Publications Company,2010

CS53: COMPILER DESIGN
(5 Hours – 5 Credits)

UNIT I

Introduction to Compilers: Compilers and translators – Why do we need translators – The structure of a compiler – Lexical Analysis – Syntax Analysis – Intermediate Code Generation – Optimization – Code Generation – Bookkeeping – Error Handling – Compiler Writing Tools.
Finite Automata and Lexical Analysis: The role of the lexical analyzer – A simple approach to the design of lexical analyzers – Regular Expressions – Finite automata – From regular expressions to finite automata –Implementation of a lexical analyzer.

UNIT II

The Syntactic Specification of Programming Languages: Context free Grammars – Derivations and parse trees – Capabilities of context free grammars.
Basic Parsing Techniques: Parsers – Shift reduce parsing – Operator precedence parsing – Top down parsing – Predictive parsers.

UNIT III

Automatic Construction of Efficient Parsers: LR parsers – The canonical collection of LR(0) items – Constructing SLR parsing tables – Constructing canonical LR parsing tables – Constructing LALR parsing tables – Using ambiguous grammars – An automatic parser generator – Implementation of LR parsing tables – Constructing LALR sets of items.

UNIT IV

Syntax-Directed Translation: Syntax directed translation schemes – Implementation of Syntax directed translators – Intermediate code – Postfix notation – Parse trees and syntax trees – Three address code, quadruples and triples – Postfix translations – Translation with a top down parser.
Symbol Tables: The contents of a symbol table – Data structures for symbol tables – Representing scope information.

UNIT V

Error Detection and Recovery: Errors – Lexical phase errors – Syntactic phase errors – Semantic errors.
Introduction to Code Optimization: The principal sources of optimization – Loop optimization – The DAG representation of basic blocks – Value numbers and algebraic laws – Global data flow analysis.

Text Book:

Principles of Compiler Design by Alfred V.Aho, Jeffrey D.Ullman Narosa Publishing House, 2002.
Unit I: Chapter 1, 3
Unit II: Chapter 4, 5
Unit III: Chapter 6
Unit IV: Chapter 7, 9
Unit V: Chapter 11, 12

Reference Book:

Compilers Principles, Techniques and Tools by Alfred V.Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, Second edition, Pearson Publications, 2007.

CS54: LAB 9: MOBILE COMPUTING
(5 Hours – 3 Credits)

Note: **Instructors are requested to design the lab exercise on their own to meet the recent technology.**

CS55: LAB 10: WEB APPLICATION DEVELOPMENT
(5 Hours – 3 Credits)

Note: **Instructors are requested to design the lab exercise on their own to meet the recent technology.**

ES2.1 : INFORMATION RETRIEVAL
(5 Hours – 5 Credits)

UNIT I

Boolean retrieval: An example information retrieval problem- A first take at building an inverted index- Processing Boolean queries- The extended Boolean model versus ranked retrieval. **The term vocabulary and postings lists:** Document delineation and character sequence decoding- Determining the vocabulary of terms- Faster postings list intersection via skip pointers- Positional postings and phrase queries. **Dictionaries and tolerant retrieval:** Search structures for dictionaries- Wildcard queries- Spelling correction- Phonetic correction.

UNIT II

Scoring, term weighting and the vector space model: Parametric and zone indexes- Term frequency and weighting- The vector space model for scoring- Variant tf-idf functions. **Computing scores in a complete search system:** Efficient scoring and ranking- Components of an information retrieval system- Vector space scoring and query operator interaction.

UNIT III

Text classification and Naive Bayes: The text classification problem- Naive Bayes text classification- The Bernoulli model- Feature selection- Evaluation of text classification.
Vector space classification: Document representations and measures of relatedness in vector spaces- Rocchio classification-k nearest neighbour- Classification with more than two classes-The bias-variance tradeoff.

UNIT IV

Support vector machines and machine learning on documents: Support vector machines: The linearly separable case- Extensions to the SVM model- Issues in the classification of text documents- Machine learning methods in ad hoc information retrieval. **Flat clustering:** Clustering in information retrieval- Problem statement- Evaluation of clustering- K-means.

UNIT V

Hierarchical clustering: Hierarchical agglomerative clustering- Single-link and complete-link clustering- Group-average agglomerative clustering- Centroid clustering- Divisive clustering-Cluster labeling.

Text Book:

Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan and HinrichSchutze, Cambridge University Press, 2014.

UNIT I: Chapters-1, 2, 3.
UNIT II: Chapters- 6, 7
UNIT III: Chapters-13, 14
UNIT IV: Chapters-15, 16
UNIT V: Chapters-17

Reference Books:

1. Information Retrieval- David A. Grossman and Ophir Frieder, Springer, 2003.
2. Modern Information Retrieval- Ricardo Baeza-Yates, Berthier Ribeiro-Neto, Pearson Edition-2003.

ES2.2 :SOFT COMPUTING
(5 Hours – 5 Credits)

UNIT I
Fundamentals of Neural Networks : Basic Concepts of Neural Network-Model of an Artificial Neuron - Neural Network Architectures - characteristics of Neural Networks - Learning Methods-Taxonomy-History of Neural Network - Early Neural Network Architectures.

UNIT II
Back propagation Networks : Architecture of Back propagation Network – Back propagation Learning - Illustrations applications - Effect of Tuning Parameters of the Back propagation Neural Network-Selection of various parameters in Back propagation Neural Network-Variations of Standard Back propagation algorithms.

UNIT III
Fuzzy Sets and Systems : Fuzzy Sets - Fuzzy Relations-Fuzzy Logic-Fuzzy Rule based system-Defuzzification Methods-Applications.

UNIT IV
Genetic Algorithms : Genetic Algorithms: History – Basic concepts – Creation of off springs – Working principle – Encoding – Fitness function – Reproduction.

UNIT V
Genetic Modelling: Inheritance operators – Cross over – Inversion and deletion – Mutation operator – Bitwise operators – Bitwise operators used in GA - Generation cycle – Covergence of Genetic algorithm- Applications.

Text Books:

Neural Networks, Fuzzy Logic and Genetic Algorithms Rajasekaran. S and Vijayalakshmi Pai. , PHI, 2008
(Chapters: 2.1, 2.3-2.9, 3.1-3.7, 6.3, 6.5, 7.3-7.6, 8.1-8.7, 9.1-9.9)

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Reference Books:
1. Soft Computing and Intelligent Systems Design ,Fakhreddine O. Karray, Clarence De Silva, Pearson, 2009.
2. Principles of Soft Computing , Sivanandam. S. N and Deepa S. N, Wiley India, 2008.
3. Practical Genetic Algorithms, Randy L. Haupt, Sue Ellen Haupt, , Second Edition, Wiley Interscience, A John Wiley & Sons, Inc., Publication. (Chapters 1,2 & 6.1)
4. First course on Fuzzy Theory and Applications, Kwang H.Lee, Springer–Verlag Berlin Heidelberg, 2005.
5. Fuzzy Sets and Fuzzy Logic-Theory and Applications George J. Klir and Bo Yuan, Prentice Hall, 1995.
6. Neural Networks Algorithms, Applications, and Programming Techniques James A. Freeman and David M. Skapura, Pearson Edn., 2003.

ES2.3: BIG DATA ANALYTICS
(5 Hours – 5 Credits)

UNIT I
Introduction to Big Data: Types of Digital Data: Classification of Digital Data, Introduction to Big Data: Characteristics of data-Evolution of Big data-Challenges of Big data-Other Characteristics of Data Which are not Definitional Traits of Big Data-Why Big Data?-Are we Just an Information Consumer or Do we also produce Information?-Traditional Business Intelligence (BI) versus Big Data – A Typical Data Warehouse Environment – A Typical Hadoop Environment – What is New Today? – What is changing in the Realms of Big Data?

UNIT II
Analytics Basics: Big Data Analytics: Where do we Begin? – What is Big Data Analytics? – What Big Data Analytics Isn't? – Why this Sudden Hype Around Big Data Analytics? – Classification of Analytics – Greatest Challenges that Prevent Business from capitalizing on Big Data – Top Challenges Facing Big Data – why is Big Data Analytics Important? – What kind of Technologies are we looking Toward to Help Meet the Challenges Posed by Big Data? – Data Science – Data Scientist... Your New Best Friend – Terminologies Used in Big Data Environments – Basically Available Soft State Eventual Consistency (BASE) – Few Top Analytics Tools.

UNIT III
Big Data Technologies: The Big Data Technology Landscape: NoSQL (Not Only SQL) – Hadoop, Introduction to Hadoop: Introducing Hadoop – Why Hadoop? – Why not RDBMS? – RDBMS versus Hadoop – Distributed Computing Challenges – History of Hadoop – Hadoop Overview – Use Case of Hadoop – Hadoop Distributors – HDFS(Hadoop Distributed File System) – Processing Data with Hadoop – Managing Resources and Applications with Hadoop YARN(Yet another Resource Negotiator) – Interacting with Hadoop Ecosystem.

UNIT IV
Introduction to MAPREDUCE Programming: Introduction – Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression, Introduction to Hive: What is Hive? – Hive Architecture – Hive Data Types – Hive File Format – Hive Query Language (HQL) – RCFile Implementation – SerDe – User – Defined Function (UDF).

UNIT V

Analytical Algorithms: Introduction to Machine Learning: Introduction to Machine Learning – Machine Learning Algorithms.

Text Book:

Big Data and Analytics, SeemeAcharya, and Subhashini Chellappan, Wiley India Pvt.Ltd. First Edition-2015.

        Unit 1 : Chapters-1,2
        Unit II: Chapter 3
        Unit III: Chapter 4,5
        Unit IV: 8,9
        Unit V: 12

Reference Books:

1. Big Data – Principles and best practices of scalable real-time data systems, Nathan Marz, and James Warren, Manning Publication cp., USA-2015.
2. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens, Wiley India Pvt.Ltd-2015.
3. Big Data, Data Mining and Machine Learning, Jared Deamn, Willey India Pvt.Ltd-2015.

ES2.4 : SOFTWARE TESTING
(5 Hours – 5 Credits)

UNIT I

SETTING THE CONTEXT: Principles of Testing – Software Development Life Cycle Models: Phases of Software Project – Quality, Quality Assurance, and Quality Control – Life cycle models. **TYPES OF TESTIING:** White Box testing – Black Box Testing.

UNIT II

SOME MORE TYPES OF TESTING: Integration Testing – System and Acceptance Testing. Performance Testing – Regression Testing.

UNIT III

SPECIALIZED TESTING: Testing of Object-Oriented Systems – Usability and Accessibility .

UNIT IV

PEOPLE AND ORGANIZATIONAL ISSUES IN TESTING: Common people issues – Organization for Testing Teams.

UNIT V

TEST MANAGEMENT AND AUTOMATION: Test planning, Execution and Reporting – Software Test Automation - Test Metrics and Measurements.

Text Book:

Software Testing – Principles and Practices Srinivasan Desikan and Gopalaswamy Ramesh,Pearson Education, 2012.

Unit I: Chapter 1,2,3,4
Unit II: Chapter 5,6,7,8
Unit III: Chapter 11,12
Unit IV: Chapter 13,14
Unit V: Chapter 15,16,17

Reference Books:

1. Effective Methods of Software Testing, William Perry, Third Edition,Wiley Publishing 2007.
2. Software Testing Principles and Practices ,Naresh Chauhan, Oxford University Press, New Delhi, 2010.

ES2.5 : WIRELESS SENSOR NETWORK
(5 Hours – 5 Credits)

UNIT I

Introduction: the vision, Networked wireless sensor devices, Applications, Key design challenges.
Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

UNIT II

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization, Theoretical analysis of localization techniques.
Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

UNIT III

Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.
Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.

UNIT IV

Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms.
Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks.

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UNIT V

Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.
Reliability and congestion control: Basic mechanisms and tunable parameters, Reliability guarantees, Congestion Control, Real-time scheduling.

Text Book:

1. Wireless Sensor Networks: Technology, Protocols, and Applications ,KazemSohraby, Daniel Minoli, TaiebZnati ,Wiley Inter Science, 2007.

Unit I	-	Chapters 1 and 2
Unit II	-	Chapters 3, 4 and 5
Unit III	-	Chapters 6 and 7
Unit IV	-	Chapters 8 and 9
Unit V	-	Chapters 10 & 11

Reference Books:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati , Wiley Inter Science.
2. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
3. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.
4. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press
5. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.
6. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.