

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

Directorate of Distance Education

Program Project Report for M.Sc., Computer science (Semester)

(I) Overview

About the Department

The Department of Computer Science in the Directorate of Distance Education of Madurai Kamaraj University is one of the oldest departments in the Directorate started in late 1970s. The department currently offers both P.G. and U.G programs in Computer Science. Every year number of students are pursuing their degree in Department of Computer Science - DDE. The department has organized 1 National seminar (Sponsored DST-PURSE) during the year 2018. Two days National webinar July 13 & 14, 2020 and one International Conference was conducted during September 23rd – 25th, 2020, (online mode due to Covid-19), respectively and carrying out research activities between the facilities and scholars Department of Computer science - DDE and the respective universities.

(II) Overview of the Program

The M.Sc. Computer Science deals with the advanced concepts of Computer Science. It incorporates Technological thinking in the minds of the students. The course provides in-depth knowledge to the students in advanced applied Computer Science and prepares them for various research activities.

(i). Programme Mission and Objective:

The mission of the Computer Science program is to provide high quality education in pure and Advances computer science in order to prepare students for higher studies or professional careers in Computer Sciences and related fields. M.Sc. Computer Science course will be a source for the promotion of problem solving, analytical thinking, and Technology development.

The main objectives of the course are:

- ❖ To prepare the students to manage the software components in a computer independently and to be a Programmer.
- ❖ To motivate the students to take up higher studies in computer science and other streams.
- ❖ Acquire good knowledge and understanding in advanced areas in Computer science and statistics.
- ❖ Provide students with knowledge of Computer science and its application.

- ❖ At a higher level, it provides the language, principles and tools to enable the engineer and scientist to invent and construct all kinds of technology for scientific and societal advancement.

(ii). Relevance of the Programme with HEI's Mission and Goals:

The post graduate Computer science course has a great relevance with the mission and goal set by the university. Every year more number of aspirants who are interested in Computer science are getting trained in DDE, MKU. The goals of this program:

- ❖ Solve complex problems by critical understanding, analysis and synthesis.
- ❖ Communicate effectively by oral, written, computing and graphical means.
- ❖ Explain the importance of Computer science and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results.
- ❖ Become sufficiently proficient in the core academic material to permit further study at the Ph.D. level in Computer science and related areas.
- ❖ Employment positions in government, industry, and non-profit organizations.

(iii). Nature of Prospective Target Group of Learners:

The M.Sc. Computer science is in demand for large number of human resource in the field of teaching and corporate sectors. Basically, this program is offered for those who do not have opportunity to attend class on regular days.

The prospective target group of learners are:

- ❖ Working Professionals
- ❖ Unemployed Graduates
- ❖ Academic Faculty
- ❖ Government Officials
- ❖ Home Makers

(iv). Appropriateness of Programme to be conducted in Open and Distance Learning Mode to Acquire Specific Skills and Competence

The program will meet the learning aspiration for computer science by providing "second chance" to those who had to discontinue their formal education or could not join regular colleges or universities owing to social, economic and other constraints.

Besides imparting theoretical knowledge, a lot of stress is laid on hands-on training and overall development of the personality. The University provides the

opportunity to the human resource, basically to the poor and rural people to get a quality education in Computer science, which can fulfil the demand of the society.

(v). Instructional Design:

The curriculum is adapted from the post graduate computer science course recommended by UGC. The curriculum has been developed with external subject matter and approved by the board of studies of the university.

(vi). Procedure for admissions, curriculum transaction and evaluation

Programme Duration: Course duration is 2 years.

Admission Procedure: Centralised admission process is conducted through online mode. Admission fees also collected through online payment gateway service.

Eligibility: Students who studied B.Sc.(CS) and BCA

Course Fee: Rs.15000/- per year (All two years excluding examination fees)

Scheme of Examination: Duration: 3 Hrs.
Maximum: 100 Marks
Passing Min: 50 Marks

Evaluation: The evaluation system is maintained as per the norms of the semester examinations of the University. The examiners for evaluation are drawn from the panel of examiners available for the DDE disciplines in the semester mode.

(vii). Requirement of the laboratory support and Library Resources: -Nil-

(viii). Cost estimate of the programme and the provisions:

Programme development : 16 subjects x Rs.9,000/- = 1,44,000/-
(Study material preparation)

Delivery (Seminar classes): 16 subjects x 36 hrs x Rs.200/- = 1,15,200/-

(ix). Quality assurance mechanism and expected programme outcomes:

Upon completion of M.Sc. Computer science programme, the student will be able to identify, formulate and solve complex the problems using the knowledge of pure computer science apply acquired knowledge of Computer science in the field of research and extension discover new knowledge to find out solutions of Complexity problems thereby promoting thirst for research produce and defend an original contribution in the related field of their choice.

Program Structure

Annexure

M.Sc., Computer Science

I SEMESTER

S.No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	CS1	Discrete Mathematical Structures	5	4	25	75
2	CS2	Advanced JAVA Programming	5	4	25	75
3	CS3	Data Structure and Algorithm	5	4	25	75
4	CS4	Lab 1: Advanced JAVA Programming Lab	5	4	40	60
		Total	20	16		

II SEMESTER

S.No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	CS5	Python Programming	5	4	25	75
2	CS6	Compiler Design	5	4	25	75
3	CS7	Operating System Design Principles	5	4	25	75
4	CS8	Lab 2: Python Programming Lab	5	4	40	60
		Total	20	16		

III SEMESTER

S.No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	CS9	Advanced Database System	5	4	25	75
2	CS10	Data Communication and Computer Networks	5	4	25	75
3	ES1	Internet of things	4	4	25	75
4	CS11	Lab 3: Advanced Database Lab	6	4	40	60
		Total	20	16		

IV SEMESTER

S.No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	CS12	Data Mining and Warehousing	5	4	25	75
2	ES2	Network Security	5	4	25	75
3	CP	Project Work & Viva voce	15	6	40	60
4	CS13	Lab 4: Linux Programming	6	4	40	60
		Total	31	18		

Note: The regular board subjects are updated so, all the materials has to be written

Syllabi (Detailed Syllabus)

CS 1: DISCRETE MATHEMATICAL STRUCTURES (5 Hours – 4 Credits)

Unit I:

Mathematical Logic: Statements and Notation – Connectives – Negation – Conjunction – Disjunction – Statement Formulas and Truth Tables — Conditional and Bi-conditional – Tautological Implications – Formulas with Distinct Truth Tables — Normal Forms – Disjunctive Normal Forms – Conjunctive Normal Forms – Principal Disjunctive Normal Forms – Principal Conjunctive Normal Forms — Theory of Inference– Rules of Inference – Inconsistency Premises- Rule CP and Indirect Method of Proof – The Predicate Calculus – Predicates – The Statement Function, Variables, and Quantifiers – Predicate Formulas – Free and Bound Variables – The Universe of Discourse – Inference Theory of the Predicate Calculus – Valid Formulas and Equivalences – Some Valid Formulas over Finite Universes – Special Valid Formulas Involving Quantifiers – Theory of Inference for the Predicate Calculus – Formulas Involving More Than One Quantifier.

Unit II:

Relations and ordering: Relations – Properties of Binary Relations in a Set – Relation Matrix and the Graph of a Relation – Partition and Covering of a Set – Equivalence Relation-Composition of Binary Relations . Partial ordering- Partial ordered set: Representation and Associated Terminology

Unit III:

Lattices and Boolean Algebra: Lattices as Partially Ordered Sets – Definition and Examples– Some Properties of Lattices – Lattices as Algebraic Systems – Sub lattices, Direct Product, and Homomorphism – Some Special Lattices – Boolean Algebra – Definitions and Examples – Sub algebra, Direct Product and Homomorphism .

Unit IV:

Graph Theory: Introduction – Basic Definitions- Degree of a vertex- some special simple graph: complete graph-Regular graph-Bipartite graph-sub graphs- Isomorphic graphs– Matrix Representation of Graphs: Adjacency matrix- Incidence Matrix –Path, cycles and connectivity- Eulerian and Hamiltonian Graphs.

Unit V:

Formal Languages and Automata Theory: Introduction – Basic definitions- Phrase structure Grammar- Types of Phrase structure Grammar- Finite state Machine- Input and output strings for FSM- Finite state Automata(FSA)-Language accepted by FSA- Deterministic and Non deterministic FSA- Language accepted by NFA- Conversion of an NFA to an Equivalent DFA

Text Book:

Discrete Mathematical Structures with Applications to Computer Science, J.P.

Tremblay and R.Manohar, McGraw Hill Book Company, New York, 1988.

Unit I – Chapter 1 – 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 (Exercises Excluded)

Unit II – Chapter 2 – 2.3(Exercises Excluded)

Unit III –Chapter 4 – 4.1,4.2(Exercises Excluded)

Unit IV –Chapter 5 –5.1.1, 5.1.2, 5.1.3 (Exercises Excluded)

Unit V –Chapter 6 – 6.1 (Exercises Excluded)

Reference Books:

1. Discrete Mathematics for Computer Scientists – John Truss – II Edition - Addison Wesley – 2000.
2. Introduction to Automata Theory, Languages and Computation – John E.HopCroit R.Motwani, Jeffery D.Ullman – III Edition Pearson Education – 2008.
3. Discrete Mathematics with Graph Theory – Goodaire Parmenter – Prentice Hall Inc., 1998.
4. Discrete and Combinational Mathematics – Ralph P.Grimaldi – Fourth Edition Pearson Education – 1999.
5. Discrete Mathematics and Graph Theory – Satyanarayana – PHI Pvt. Ltd., - 2009.

**CS 2: ADVANCED JAVA PROGRAMMING
(5 Hours – 4 Credits)****Unit I :**

Applets : Applet Fundamentals - Applet Class - Applet Life Cycle – Steps for developing an Applet Program – Passing values through Parameters - Graphics in an Applet – Event handling GUI Applications: Graphical User Interface - Creating Windows - Dialog Boxes – Layout Managers - AWT Component classes - Swing Component classes – Event handling – Other AWT Components – AWT graphics classes – Other Swing controls

Unit II :

Networking: Basics - Networking in Java -Socket Programming using TCP/IP – Socket Programming using UDP – URL and Inet Address Classes. Java Database Connectivity: Types of drivers - JDBC Architecture – JDBC Classes and Interfaces – Basic steps in developing JDBC applications – Creating a new database and table with JDBC - Working with Database metadata

Unit III :

Servlets: - Basics – Advantages - Servlet alternatives – strengths – Architecture - Servlet Life Cycle - Generic Servlet - HTTP Servlet- Passing parameters – Retrieving parameters – server side include - Cookies –Filters

Unit IV:

Java Server Pages: Overview - JSP and HTTP – JSP Engines - Working of JSP – Anatomy of JSP – JSP Syntax – Creating simple JSP page - Components of JSP -Implicit Objects

Unit V:

Web Programming – Client Side Programming: Client Side Programming technologies – Form design with HTML and CSS – Client side Validation using JavaScript - Content Structuring using XML – Adding interactivity with AJAX

Web Programming - Server Side Programming: Web Servers - Handling Request and Response - Database Access- Session Management

Text Book:

Java Programming for Core and Advanced Learners - Sagayaraj, Denis , Karthik and Gajalakshmi , University Press, 2018

Unit I	:	Chapters 12,13 and 14
Unit II	:	Chapters 15 and 16
Unit III	:	Chapter 19
Unit IV	:	Chapter 20
Unit V	:	Chapters 21 and 22

Reference Books:

1. Java The Complete Reference - Herbert Schildt, McGraw Hill Education, 10th Edition, New York, 2017
2. Advanced Java Programming – Uttam K.Roy , Oxford University Press, 2017
3. Core and Advanced Java, Black Book – Dreamtech Press, 2017

CS 03: DATA STRUCTURES AND ALGORITHMS

(5 Hours – 4 Credits)

Unit I :

Trees: Heaps – Binary Search Trees – Selection Trees – Forests – Representation of Disjoint Sets – Counting Binary Trees.Graphs: The Graph Abstract Data type – Elementary Graph

Operations – Minimum Cost Spanning Trees – Shortest Paths and Transitive Closure – Activity Networks.

Unit II :

Hashing: Introduction – Static hashing – Dynamic hashing – Bloom filters. Priority Queues: Single- and Double ended priority queues– Fibonacci Heaps – Pairing Heaps – Symmetric Min-Max Heaps.

Unit III:

Efficient binary search trees: Optimal Binary Search Trees – AVL Trees – Red-Black Trees – Splay Trees. Multiway Search Trees: m-way Search Trees – B-Trees – B+-Trees.

Unit IV:

Dynamic Programming: The General Method – Multistage graphs – All-pairs shortest paths – Optimal binary search trees – string editing – 0/1 knapsack – reliability design – The Travelling Salesperson problem. Basic Traversal and Search Techniques: Techniques for Binary Trees – Techniques for Graphs – Connected Components and Spanning Trees – Biconnected Components and DFS.

Unit V :

Backtracking: The General Method – The 8-Queens Problem – Sum of subsets – Graph coloring – Hamiltonian cycles – Knapsack problem..

Text Books:

1. Fundamentals of Data Structures in C++ – Ellis Horowitz, Sartaj Sahni, Dinesh Mehta – University Press(India) Private Limited, Second Edition, Reprinted 2017.

Unit I : Chapter 5.6 – 5.11 and 6

Unit II : Chapter 8 and 9

Unit III : Chapter 10 and 11

2. Fundamentals of Computer Algorithms - Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran – University Press(India) Private Limited, Second Edition, Reprinted 2017.

Reference Books:

Unit IV : Chapter 5 and 6

Unit V : Chapter 7 and 8

1. Data Structures and Algorithms, Alfred V.Aho, John E.Hopcraft and Jeffrey D.Ullman, Pearson Education, Fourteenth Impression, 2013.

2. Classic Data Structures in C++, Timothy A. Budd - Addison Wesley Publishing Co., First Edition.,1994.
3. Data Structure and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, Addison Wesley Publishing Company, 1997.
4. Computer Algorithms – Introduction to Design & Analysis, Sara Baase and Allen Van Gelder, Third Edition, Pearson Education, New Delhi, 2000.
5. Data Structures, A. Chitra, P. T. Rajan, Vijay Nicol Imprints Pvt Ltd, Mc Graw Hill Education of India Pvt. Ltd., 2006. Design and Analysis of Algorithms – S.Sridhar, Oxford University Press, 2015

**CS 4: LAB 1- ADVANCED JAVA PROGRAMMING LAB
(5 Hours – 3 Credits)**

1. Script showing use of variables in JavaScript
2. Script showing use of arrays in JavaScript.
3. Script showing user defined functions
4. Script showing how JavaScript places code in the browser window
5. Script showing use of alert dialog box
6. Script showing use of prompt dialog box
7. Script showing use of Confirm dialog box
8. Program showing JavaScript front-end validation
9. Program implementing the concept of cookies in JSP
10. Program implementing the concept of session in JSP

Reference Books

1. Java The Complete Reference - Herbert Schildt, McGraw Hill Education, 10th Edition, New York, 2017
2. Programming in Java – Sachin Malhotra, Saurbh Choudhary, Oxford University Press, Revised Second Edition.

Note: The above are sample problems; Instructor can add more exercises based on their requirements and the current technology

II SEMESTER

CS 5: PYTHON PROGRAMMING (5 Hours – 4 Credits)

Unit I :

Python Programming: An Introduction - IDLE an Interpreter for Python, Python Strings, Relational Operators, Logical Operators, Bitwise Operators, Variables and Assignment Statements, Keywords, Script Mode. Functions - Built-in Functions, Function Definition and Call, Importing User-defined Module, Assert Statement, Command Line Arguments. Control Structures - if Conditional Statement, Iteration (for and while Statements).

Unit II :

Scope - Objects and Object ids, Scope of Objects and Names. Strings - Strings, String Processing Examples, Pattern Matching. Mutable and Immutable Objects – Lists, Sets, Tuples, Dictionary.

Unit III :

Recursion - Recursive Solutions for Problems on Numeric Data, Recursive Solutions for Problems on Strings, Recursive Solutions for Problems on Lists, Problem of Tower of Hanoi. Files and Exceptions - File Handling, Writing Structures to a File, Errors and Exceptions, Handling Exceptions Using try...except, File Processing Example.

Unit IV :

Classes I - Classes and Objects, Person: An Example of Class, Class as Abstract Data Type, Date Class. Classes II - Polymorphism, Encapsulation, Data Hiding, and Data Abstraction, Modifier and Accessor Methods, Static Method, Adding Methods Dynamically, Composition, Inheritance, Built-in Functions for Classes.

Unit V :

Graphics - 2D Graphics, 3D Objects, Animation – Bouncing Ball. Applications of Python - Collecting Information from Twitter, Sharing Data Using Sockets, Managing Databases Using Structured Query Language (SQL), Developing Mobile Application for Android, Integrating Java with Python, Python Chat Application Using Kivy and Socket Programming.

Text Book:

Python Programming a Modular Approach with Graphics, Database, Mobile, and Web Applications – Sheetal Taneja, Naveen Kumar – Pearson Publication, 2018.

Unit I : Chapters 1,2,3

Unit II	:	Chapters 5,6,7
Unit III	:	Chapters 8,9
Unit IV	:	Chapters 10,11
Unit V	:	Chapters 17,18

Reference Books:

1. Python Programming - Reema Thareja, Oxford University Press, 2017
2. Fundamentals of Python Programming, Lambert – Cengage Publications, 2017
3. Problem Solving using Python – E. Balagurusamy, Mc Graw Hill Education Ltd., 2017

CS 6: COMPILER DESIGN (5 Hours – 4 Credits)

Unit I:

Compilers and Translators-Why Do We Need Translators?-The Structure Of A Compiler-Lexical Analysis-Syntax Analysis-Intermediate Code Generation-Optimization-Code Generation-Book Keeping-Error Handling-Compiler-Writing.

Tools-Getting started. The role of the lexical analyser -Simple approach to design of a lexical analyser -Regular Expressions- Finite Automata-From regular expression to finite automata-Minimizing the number of states of a DFA-A language for specifying lexical analyser - Implementing a lexical analyser - The scanner generator as Swiss army Knife.

Unit II:

The Syntactic Specification of Programming Languages-Derivation and Parse Trees-Capability of context free Grammars. Parsers-Shift-reduce Parsing-Operator-precedence parsing-Top-down parsing-Predictive Parsers.

Unit III:

LR parsers-The canonical collection of LR(0) items-constructing SLR parsing tables – constructing canonical LR parsing tables-constructing SLR parsing tables-constructing LALR parsing tables – Using Ambiguous grammars- An automatic parse generator Implementation of LR parsing Tables – constructing LALR set of items. Syntax directed translation schemes – Implementation if syntax directed schemes-Intermediate Code-Parse Tree and Syntax Trees –Three Address code, quadruples, and triples-Translation of assignment statements-Boolean Expression-Statements that alter the flow of control-postfix translations-Translation with a top-down parser.

Unit IV:

The contents of a symbol tables-Data structure for a symbol table-Representing Scope information. Errors-Lexical-phase errors - syntactic-phase errors-Semantic errors. The

principal sources of optimization-Loop optimization -The DAG representation of basic blocks-Value numbers and algebraic laws-Global data-flow analysis.

Unit V:

Dominators – Reducible – Flow graphs - Depth-firstsearch - Loop - invariant computations – Induction variable elimination-Some other loop optimization. Code Generation-Object Programs- A machine Model- A simple code generator- Register allocation and assignment-Code generation from DAG's-Peephole Optimization.

Text Book:

Principles of Compiler Design, Alfred V.Aho and Jeffrey D.Ullman.25th Reprint, Addison-Wesley Series, 2002.

Unit I	:	Chapters 1,3
Unit II	:	Chapters 4,5
Unit III	:	Chapters 6,7
Unit IV	:	Chapters 9,11,12
Unit V	:	Chapters 13,15

Reference Books:

1. Compiler Principles, Techniques and Tools by Alfred V.Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, Second edition, Pearson Publications, 2007.
2. Advanced Compiler Design and Implementation - Steven S. Muchnick, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Introduction to Compiler Techniques, J.P. Bennet, Second Edition, Tata McGraw-Hill, 2003.

CS 7: OPERATING SYSTEM DESIGN PRINCIPLES (5 Hours – 4 Credits)

Unit I:

Computer system overview – basic elements - processor registers – instruction execution – interrupts – memory hierarchy – cache memory – I/O communication techniques. Operating system overview – operating system objectives and functions – evolution of operating systems – major achievements – developments leading to modern operating systems.

Unit II:

Process description and control – what is a process? – Process states – process description – Process control – execution of operating system – security issues. Threads, SMP, Micro kernels –processes and threads – symmetric multiprocessing – micro kernels. Concurrency: Mutual exclusion and Synchronization - Principles of concurrency –mutual exclusion: hardware support – semaphores – monitors – message passing – reader/writer problem.

Unit III:

Concurrency: Deadlock and Starvation – principles of deadlock – deadlock prevention – deadlock avoidance – deadlock detection – an integrated deadlock strategy – Memory management – memory management requirements – memory partitioning – paging – segmentation – security issues. Virtual memory – hardware and control structures – operating system software – windows vista memory management.

Unit IV:

Uni processor scheduling – types of scheduling – scheduling algorithms. Multiprocessor and Real time scheduling – multiprocessor scheduling – real time scheduling – windows vista scheduling.

Unit V:

I/O management and Disk scheduling – I/O devices – organization of I/O function – operating system design issues – I/O buffering – disk scheduling – RAID – disk cache – windows vista I/O. File management – overview – file organization and access – file directories – file sharing – record blocking – secondary storage management – file system security – windows vista file system.

Text book:

Operating Systems - Internals and Design Principles, William Stallings, Sixth Edition, Pearson Education Ltd, 2014

Unit I	:	Chapter 1.1 to 1.7, 2.1 to 2.5
Unit II	:	Chapter 3.1 to 3.6, 4.1 to 4.4, 5.1 to 5.6
Unit III	:	Chapter 6.1 to 6.6, 6.10, 7.1 to 7.5, 8.1, 8.2, 8.5
Unit IV	:	Chapter 9.1, 9.2, 10.1, 10.2, 10.5
Unit V	:	Chapter 11.1 to 11.7, 11.10, 12.1 to 12.7, 12.10

Reference Books:

1. Operating System Concepts: Abraham Silberschatz, 8th Edition, Wiley Student Edition 2009.
2. Operating system – A Design Oriented Approach, Charles Crowley, McGraw-Hill Education, 2009.
3. Operating Systems: Concepts & Design: Milan Milenkovic, 2nd Edition, Mc Graw- Hill Education, 2001

**CS 8 : PYTHON PROGRAMMING - LAB 3
(5 Hours – 3 Credits)**

Section: A

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number) 16
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

Reference Books :

1. Problem solving and Python Programming – s.A.Kulkarni, Yesdee Publisher, 2017
2. Python Programming a Modular Approach with Graphics, Database, Mobile, and Web Applications – Sheetal Taneja, Naveen Kumar – Pearson Publication, 2018.

Note: The above are sample problems; Instructor can add more exercises based on their requirements and the current technology.

III SEMESTER

CS 9: ADVANCED DATABASE SYSTEM (5 Hours – 4 Credits)

Unit I :

Database System: Introduction-Overview of Database Management Systems-Data Independence-Database System Architecture- The External Level – The Conceptual Level – The Internal Level – Mappings – The Database Administrator – Data Dictionary – Data Models – Record-Based Data Models – Object based Data Models – Physical Data Models- Hierarchical Data Models – Network Data Models-Relational Data Model-Entity-Relationship Models – Object Oriented Data Model.

Unit II :

Distributed Databases and Decision Support: Preliminaries-The Objectives and problems of Distributed Databases - Client/Server Systems – DBMS Independence-SQL Facilities – Decision Support-Data Preparation-Data Warehouses and Data Marts – Online Analytical Processing – Object Oriented Databases: Introduction-Object Oriented Data Models-Object Oriented Database-Object Oriented DBMS – Object Oriented Languages.

Unit III :

Temporal Databases: Introduction-Intervals-Packing and Unpacking relations-Generalizing the relational operators – Database Design – Integrity Constraints – Multimedia Databases: Multimedia Sources – Multimedia Database Queries – Multimedia Database Applications.

Unit IV :

Spatial Databases: Spatial Data- Spatial Database Characteristics – Spatial Data Model-Spatial Database Queries – Techniques of Special Database Query- Logic based Databases: Introduction-Overview-Proportional calculus – Predicate Calculus – Deductive Database Systems – Recursive Query Processing.

Unit V :

Emerging Database Technologies: Introduction – Internet Databases – Multimedia Databases – Mobile Databases – MySQL : Introduction – An Overview of MySQL – MySQL Database.

Text Book:

An Introduction to Database Systems - C.J.Date, A.Kannan, S.Swamynathan -8th Edition-Pearson Education-2006.

Reference Books:

1. Database Systems: Concepts, Design and Applications -S.K. Singh-2nd Edition, Pearson Education- 2008.
2. Database Management System Concepts - Abraham Silberschatz, Henry F.Korth and S.Sudarshan-McGraw Hill International Edition-2006.
3. Fundamentals of Database Systems - R. Elmasri, S.B. Navathe- Fifth Edition, Pearson Education- 2006.

**CS 10: DATA COMMUNICATIONS AND COMPUTER NETWORKS
(5 Hours – 4 Credits)**

Unit I:

Data Communications, Data Networking and the Internet: Data Communications and Networking for Today's Enterprise – A Communication Model - Data Communications –

Networks – The Internet – An Example Configuration. Protocol Architecture, TCP/IP and Internet-Based Applications. The Need for a Protocol Architecture – The TCP/IP Protocol Architecture– The OSI Model – Standardization within a Protocol Architecture- Traditional Internet-Based Applications – Multimedia. Transmission Media - Guided Transmission Media – Wireless Transmission - Wireless Propagation – Line of Sight Transmission

Unit II:

Digital Data Communication Techniques- Asynchronous and Synchronous Transmission – Types of Errors – Error Detection –Error Correction –Line Configuration-Data Link Control Protocols – Flow Control – Error Control – High Level Data Link Control Multiplexing – Frequency Division Multiplexing – Synchronous - Time Division Multiplexing – Statistical Time Division Multiplexing – Asymmetric Digital Subscriber Line

Unit III:

Wide Area Networks: Circuit Switching and Packet Switching – Switched Communication Networks– Circuit Switching Networks - Circuit Switching Concepts – Softswitch Architecture – Packet Switching Principles – X .25 – Frame Relay Asynchronous Transfer Mode – Protocol Architecture – ATM Logical Connections –ATM Cells – Transmission of ATM Cells - Routing in Switched Networks – Routing in Packet switching Networks – Examples : Routing in ARPANET- Least-Cost Algorithms

Unit IV:

Local Area Networks: Background – Topologies of Transmission Media – lan Protocol Architecture – Bridges – Layer 2 and Layer 3 Switches - Internet and Transport Protocols - Internet Protocols – Basic Protocol Functions – Principles of Internetworking – Internet Protocol Operation – Internet Protocol – IPv6 - Internetwork Operation- Multicasting – Routing Protocols - Integrated Services Architecture – Differentiated Services – Service Level Agreements – IP Performance Metrics

Unit V:

Transport Protocols - Connection-Oriented Transport Protocol Mechanisms – TCP –TCP Congestion Control – UDP- Internet Applications - Electronic Mail and Network Management - Electronic Mail: SMTP and MIME – Network Management SNMP - Internet Applications – Internet Directory Service and World Wide Web – Internet Directory Service DNS – Web Access HTTP

Text Book

Data and Computer Communication - William Stallings – 10th Edition – Pearson, 2013

Unit I : Chapters 1,2,4
Unit II : Chapters 6,7,8.1-8.4

Unit III	:	Chapters 10,11.1-11.4,12
Unit IV	:	Chapters 15,18.1-18.6,19
Unit V	:	Chapters 20,22,23

Reference Books

1. Computer Networks – Andrew S. Tanenbaum and David J Wetherall– 5th Edition – Pearson , 2013
2. Data communications and Networking - Behrouz A. Forouzan – 4th Edition - Mc Graw Hill, 2017.
3. Data Communication and Networks - Bhushan Trivedi , Oxford University Press 2016.

ES 1: INTERNET OF THINGS (5 Hours – 4 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 & Life style.

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 IoT Python – Other devices. 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 REST full Web API – Amazon Web Services for IoT – SkynetIoT 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 Map Reduce for Batch Data Analysis – Apache Oozier – Apache Spark – Apache Storm – Using Apache Storm for Real-time Data Analysis.

Text Book:

1. Internet of Things, Arshdeep Bahga, Vijay Madiseti, Universities Press (INDIA) Private Ltd., 2015.
Unit I : Chapters 1 and 2
Unit II : Chapters 3 and 4
Unit III : Chapters 5 and 6
Unit IV : Chapters 7 and 8
Unit V : Chapters 9 and 10

Reference Books:

1. Getting Started with the Internet of Things, CunoPfister, O'Reilly, 2011.
2. Designing the Internet of Things, AdrianMcewen, HakinCassimally, Willey,2015.
3. The Internet of Things in the Cloud: A Middleware Perspective,Honbo Zhou, CRC Press, 2012.
4. Architecting the Internet of Things, Dieter Uckelmann; Mark Harrison; Florian Michahelles, (Eds.) Springer, 2011.
5. The Internet of Things , Key Applications and Protocols, Oliver Hersent, David Boswarthick, Omar Elloumi, Wiley , 2017

CS 11: LAB 6. ADVANCED DATABASE LAB
(5 Hours – 3 Credits)

- a) 1. Implement Data Definition Language (Create, Alter, Drop, Truncate, and Rename) & Data Manipulation Language (Insert, Update, and Delete).
Implement SELECT command with different clauses (Where clause, having clause, Group by clause, Order by clause).
Implement Single Row function (character, numeric, data functions).
To implement Group function (AVG, MIN, MAX, SUM).
Implement various types of SET operators (Union, Intersect, Minus).
Implement various types of integrity constraints (NOT NULL Constraint, DEFAULT Constraint, UNIQUE Constraint, PRIMARY Key, FOREIGN Key, CHECK Constraint).
Implement various types of joins (Left Join, Right Join, Outer Join, and Inner Join).
Data Definition Language: Create, Alter, Drop, Rename, Truncate.
Data Manipulation Language: Insert, Update, Delete, Select.

Data Control Language: Grant, Revoke, Roles

Transaction Control: Commit, Rollback, Savepoint

(6) SQL SELECT Statements: Selecting All Columns, Selecting Specific Columns, Column Alias, Concatenation Operator, Arithmetic Operators, Comparison Conditions, Logical Conditions, ORDER BY Clause

(7) Functions: Single Row Functions, Character Functions, Number Functions, Date Functions, Conversion Functions, General Functions, Multiple Row Functions, Group Function.

Subquery: Subquery, Types of Subquery, Group Function, Having Clause

Joins: Equijoins, Non-Equijoins, Joining Three Tables, Self Joins, Left Outer Joins, Right Outer Joins, Full Outer Joins, Cross Joins, Natural Joins

Other Concepts: Sequence, View, Index, Synonyms

Constraints: Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint, Enabling & Disabling

b) PL/SQL Practical

Programming: Variables, Identifiers, Comment, PL/SQL Block Structure

IF Statements: Simple IF Statements, Compound IF Statements

IF-THEN-ELSE Statements

Loop: Basic Loop, WHILE Loop, FOR Loop

DML Operations Using PL/SQL: Insert, Update, Delete, Merge 4 Hrs.

Cursor: Types of Cursor, Explicit Cursor Life Cycle, Explicit Cursor Attributes

Trigger: Trigger, Statement Trigger, Row Trigger, Using Conditional Operations, DML Operations

Exceptions: Block Structure, Exception Handlers, Types of Exceptions

Records: Table-Based, Cursor-Based, Programmer-Defined

Functions: Create Function, Function with Arguments, Executing Function, Dropping Function

Procedures: Block Structure of Subprogram, Types of Subprograms, Procedure with Parameters, Executing Procedures, Dropping Procedures

c) Packages: Package Specification, Package Body, Creating Package, Execution, Dropping Package

Reference Book :

1. R Programming – An approach to Data Analytics – Dr. Sudhamathy & Dr. Jothi Venkateshwaran, MJP Publishers, 2018

2. Statistical Programming in R - K G Srinivasa , G M Siddesh, Chetan Shety, B.J Sowmya, - Oxford University Press, 2017
3. Design and Implementation of Data Mining Tools – M.Awad, Latifur Khan, Bhavani Thirissingham, Lei Wang – CRC Press, Taylor & Francis Group, 2015.

Note: The above are sample problems; Instructor can add more exercises based on their requirements and the current technology.

IV SEMESTER

CS12: DATA MINING AND WAREHOUSING (5 Hours – 4 Credits)

Unit I:

Introduction - Why Data Mining? - What is Data Mining? - What Kinds of Data Can Be Mined? - What Kinds of Patterns Can Be Mined? - Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Getting to Know Your Data: Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Data Visualization –Measuring Data Similarity and Dissimilarity.

Unit II:

Data Preprocessing : Data Preprocessing An Overview - Data Cleaning - Data Integration - Data Reduction - Data Transformation and Data Discretization - Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts - Data Warehouse Modeling: Data Cube and OLAP - Data Warehouse Design and Usage - Data Warehouse Implementation - Data Generalization by Attribute - Oriented Induction.

Unit III:

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods - Frequent Item set Mining Methods - Which Pattern Are Interesting? - Pattern Evaluation Methods. Advanced Pattern Mining : Pattern Mining: A Road Map - Pattern Mining in Multilevel, Multidimensional Space - Constraint - Based Frequent Pattern Mining - Mining High - Dimensional Data and Colossal Patterns - Mining Compressed or Approximate Patterns - Pattern Exploration and Application.

Unit IV:

Classification: Basic Concepts - Basic Concepts - Decision Tree Induction - Bayes Classification Methods - Rule-Based Classification- Model Evaluation and Selection - Techniques to Improve Classification Accuracy.

Unit V:

Cluster Analysis Basic Concepts and Methods: Cluster Analysis - Partitioning Methods - Hierarchical Methods - Density Based Methods - Grid Based Methods - Evaluation of Clustering.

Text Book:

Data Mining Concepts and Techniques - Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann Publisher, 2012.

Unit I	:	Chapters	1 and 2
Unit II	:	Chapters	3 and 4
Unit III	:	Chapters	6 and 7
Unit IV	:	Chapter	8
Unit V	:	Chapter	10

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. Introduction to Data Mining Pang-Ning Tan, Michael Steinbach and Vipin Kumar, , Pearson Education, 2007.
4. Modern Data Warehousing, Mining and Visualization, Marakas, George M, Pearson Education, 2011.

ES 2: NETWORK SECURITY
(6 Hours – 4 Credits)

Unit I:

Introduction: Security Goals –Attacks–Services and Mechanism – Techniques.
Mathematics of Cryptography: Integer Arithmetic – Modular Arithmetic – Matrices – Linear Congruence - Traditional Symmetric Key Ciphers: Instruction – Substitution Ciphers – Transposition Ciphers – Stream and Block Ciphers. Introduction to Modern Symmetric Key Ciphers: Modern Block Ciphers – Modern Stream Ciphers.

Unit II:

Data Encryption Standard (DES): Introduction – DES Structure – DES Analysis – Multiple DES – Security of DES. Advanced Encryption Standard (AES): Introduction – Transformations – Key Expansion – Ciphers – Examples – Analysis of AES.

Unit III :

Asymmetric Key Cryptography: Introduction – RSA Crypto System. Message Integrity and Message Authentication: Message Integrity – Random Oracle Model – Message Authentication.

Unit IV:

Cryptographic Hash Functions: Introduction – SHA – 512 – WHIRLPOOL. Digital Signature: Comparison – Process – Services – Attacks on Digital Signature – Digital Signature Schemes.

Unit V:

Entity Authentication: Introduction – Passwords – Challenge Response – Zero Knowledge – Bio Metrics. Key Management: Symmetric Key Distribution – Kerberos – Symmetric Key Agreement – Public Key Distribution.

Text Book:

Cryptography and Network Security – Behrouz A. Forouzan, TheMcGraw Hill, 2011.

Reference Books:

Unit I : Chapters 1,2,3 and 5
Unit II : Chapters 6 and 7
Unit III : Chapters 10 and 11
Unit IV : Chapters 12 and 13
Unit V : Chapters 14 and 15

1. Cryptography and Network Security – William Stallings, PHI, 2008.
2. Cryptography and Network Security – Atul Kahate, McGraw Hill Education, 2013.
3. Network Security The Complete Reference – Roberta Bragg, Mark Rhodes Ousley and Strassberg – McGraw Hill Education, 2003.

CS13: Lab 4: Linux Programming
(2 Hours – 4 Credits)

Section-A

1. Write a Linux script to see the current date, user name and current directory.
2. Write a Linux script to print the numbers 5,4,3,2,1 using While loop.
3. Write a Linux script to set the attributes of a file.
4. Write a Linux script to convert lowercase to uppercase using tr utility.

5. Write a Linux script to copy and rename a file.
6. Write a Linux script to add 5 numbers and find the average.
7. Write a Linux script to convert a decimal number to hexadecimal conversion.
8. Write a Linux script to find the factorial of a number.
9. Write a Linux script to check for palindrome.

Section-B

1. Write a Linux script to display Hello World in Bold, Blink effect and in different colors like red, green etc.
 2. Write a Linux script to display a multiplication table.
 3. Write a Linux script to perform arithmetic operations using case.
 4. Write a Linux script to add two real numbers.
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1. Write a Linux script to find the sum of digits and reversing of a given number.
 2. Write a Linux script to display the student mark details.
 3. Write a Linux script to prepare electricity bill.
 4. Write a Linux script to sort the numbers in ascending order.