

**ANNAMALAI UNIVERSITY****M.Sc. (COMPUTER SCIENCE)**

Programme Structure and Scheme of Examination (under CBCS)
 (Applicable to the candidates admitted from
 the academic year 2022 -2023 onwards)

Sem	Course Code	Study Components & Course Title	Hours	Credit	Maximum Marks		
					CIA	ESE	Total
		SEMESTER-I					
I	22PCSCC11	Core Theory - I :Design and Analysis of Algorithm	5	4	25	75	100
	22PCSCC12	Core Theory -II: Advanced Java Programming	5	4	25	75	100
	22PCSCC13	Core Theory -III: Advanced Database Management System	5	4	25	75	100
	22PCSCP14	Core Practical- I:Algorithm LAB using JAVA	4	2	40	60	100
	22PCSCP15	Core Practical- II: Advanced RDBMS LAB	4	2	40	60	100
	22PCSCE16	Core Elective-I	4	4	25	75	100
	22PCSCO17	Open Elective-I	3	3	25	75	100
		Total	30	23			700
		SEMESTER-II					
II	22PCSCC21	Core Theory -IV: Advanced Web Technology	5	4	25	75	100
	22PCSCC22	Core Theory -V:DataMining and Business Intelligence	5	4	25	75	100
	22PCSCC23	Core Theory -IV: Distributed Operating System	5	4	25	75	100
	22PCSCP24	Core Practical- III: Advanced Web Technology LAB	4	2	40	60	100
	22PCSCP25	Core Practical-IV: Data Mining Lab Using R	4	2	40	60	100
	22PCSCE26	Core Elective-II	5	4	25	75	100
	22PHUMR27	Compulsory Course: Human Rights	2	2	25	75	100
		Total	30	22			700

Sem	LIST OF CORE ELECTIVE PAPERS (Choose 1 out 3 in each Semester)						
I	22PCSCE16-1	Compiler Design	4	4	25	75	100
	22PCSCE16-2	Human Computer Interaction	4	4	25	75	100
	22PCSCE16-3	Theory of Computation	4	4	25	75	100
II	22PCSCE26-1	Cryptography and Network Security	4	4	25	75	100
	22PCSCE26-2	Open Source Computing	4	4	25	75	100
	22PCSCE26-3	Soft Computing	4	4	25	75	100

Sem	List of Open Electives (Choose 1 out 3 in each Semester)						
I	22PCSCO17-1	Fundamentals of Computer Application	3	3	25	75	100
	22PCSCO17-2	IoT and its Applications	3	3	25	75	100
	22PCSCO17-3	Multimedia and its applications	3	3	25	75	100

SEMESTER - I CORE - I PART -	22PCSCC11: DESIGN AND ANALYSIS OF ALGORITHMS	CREDITS: 4 HOURS:
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COURSE OBJECTIVES

- LO1 Learning basic concepts of Algorithm
- LO2 Method of sorting algorithms analyzed
- LO3 To Analyze Greedy Algorithm and Knapsack Problem
- LO4 To analyze Dynamic Programming
- LO5 To learn effective problem solving in Computing applications and analyze the algorithmic procedure to determine the computational complexity of algorithms.

UNIT I

Introduction: Algorithm Definition–Algorithm Specification–Performance Analysis-Asymptotic Notations. Elementary Data Structures: Stacks and Queues–Trees–Dictionaries – Priority Queues–Sets and Disjoint Set -Union–Graphs

UNIT II

Divide and Conquer: The General Method – Defective Chessboard –Binary Search – Finding the Maximum and Minimum – Merge Sort –Quick Sort – Selection-Strassen’s Matrix Multiplication.

UNIT III

The Greedy Method: General Method-Container Loading-Knapsack Problem-Tree Vertex Splitting–Job Sequencing With Deadlines-Minimum Cost Spanning Trees- Optimal Storage On Tapes–Optimal Merge Patterns-Single Source Shortest Paths.

UNIT IV

Dynamic Programming: The General Method – Multistage Graphs –All-Pairs Shortest Paths–Single-Source Shortest Paths-Optimal Binary Search Trees-String Editing-0/1Knapsack- Reliability Design - The Traveling Salesperson Problem - Flow Shop Scheduling. Basic Traversal and Search Techniques: Techniques for Binary Trees –Techniques for Graphs–Connected Components and Spanning Trees–Bi connected Components and DFS.

UNIT V

Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets–Graph Coloring–Hamiltonian Cycles–Knapsack Problem Branch and Bound: Least Cost searchhod-0/1Knapsack Problem.

Text Book

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, Second Edition, Reprint 2009.

Supplementary Readings

1. Data Structures Using C-Langsam, Augenstein, Tenenbaum, PHI
2. Data structures and Algorithms, V.Aho, Hopcroft, Ullman, LPE
3. Introduction to design and Analysis of Algorithms-S.E.Goodman, ST.Hedetniem-TMH.
4. Carlos A. Coello, Gary B. Lamont, David A. Van Veldhuizen, "Evolutionary Algorithms for Solving Multi-Objective Problems", Springer 2nd Edition, 2007.

COURSE OUTCOMES

At the end of the course, the student will be able to

- CO1 Acquire knowledge on the concepts of Algorithm
- CO2 Implementing various Algorithmic and sorting approach
- CO3 Able to develop Greedy Algorithm
- CO4 Acquire knowledge in Dynamic Programming
- CO5 Develop Back tracking methods and its applications

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	2	3	3	2	2
CO4	1	3	3	2	1
CO5	2	3	3	3	2

SEMESTER - I	22PCSCC12: ADVANCED JAVA PROGRAMMING	CREDITS: 4
CORE -		HOURS: 75
PART -		

COURSE OBJECTIVES

- LO1 To get familiar with the concept of packages, interface
- LO2 Able to understand Inheritance and Exception handling in java.
- LO3 To learn the concept of Graphical User Interface (GUI)
- LO4 Analyse Network Programming, and database manipulation
- LO5 Student will be able to develop web application using Java Servlet and Java Server Pages technology

UNIT I

Data Types, Variables and Arrays: Primitive Types-Literals-Variables-Type Conversion and Casting- Arrays. Operators: Arithmetic- Bitwise-Relational-Boolean-Logical – Assignment-Conditional. Control Statements: Selection statements- Iteration Statements- Jump Statements. Classes and Methods: Fundamentals- Declaring objects- Methods- Constructors-Overloading Methods- Recursion – Nested and Inner Classes-Command Line Arguments.

UNIT II

Inheritance: Basics-Super Class- Method Overriding- Abstract Classes. Packages and Interfaces: Packages- Access Protection – Importing Packages- Interfaces. Exception Handling: Fundamentals – Types – Try and Catch – Throw – throws- Finally – Built in Exceptions.

UNIT III

The Applet Class: Basics – Architecture – Applet Skeleton – Display Methods – Status Window- Passing Parameters. Event Handling: Event Model – Classes – KeyEvent Class- Event Listener Interfaces. AWT: Window Fundamentals – Working with frame windows- Graphics- Working with color- working with fonts. AWT controls – Labels- Buttons- Check Box- Choice Controls – Lists- Scroll Bars – TextField- Text Area.

UNIT IV

Servlet Fundamentals: Servlet overview and Architecture- Servlet Basics- Servlets and HTML- servlet Sessions- Servlets, JDBC, and Inter Servlet Communications. JSP Fundamentals: JSP Overview and Architecture – JSP Implicit Objects – JSP Standard Actions- Handling JSP Errors – Custom JSP Tag Libraries.

UNIT V

Using Relational Databases: Introduction – JDBC Drivers for RDBM Systems- Using java.sql API, Using javax.sql API – connection pooling. Network Programming: Introduction – Working with URLs – Working with Sockets – Remote Method Invocation.

Text Books

1. Herbert Schildt, “Java the Complete Reference”, Oracle Press, TMH Company Ltd, New Delhi, 9th Edition, 2014.
2. James goodwill, “ Developing Java Servlets: Web applications with servlets and JSP”, 2nd Edition, SAMS Publishers, USA
3. Joe Wiggles worth and Paula McMillan, “Java Programming Advanced Topics”, 3rd Edition, TMH, 2009.

Supplementary Readings

1. Alan Grid, “Java Programming”, Via Etenea Limited, 2020.
2. John Dean, Raymond Dean, “Introduction to Programming with JAVA- A Problem Solving Approach”, Tata McGraw Hill, 2012.
3. Ralph Bravaco, Shai Simonson, “Java Programming: From the Ground Up”, Tata McGraw Hill, 2012.
4. Herbert Schildt, Dale Skrien, “Java Fundamentals – A Comprehensive Introduction”, Tata McGraw Hill, 2013.
- 5.

Course Outcomes

At the end of the course, the student will be able to

- CO1 Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
- CO2 Use the Java language for writing well-organized, complex computer programs with both command line and graphical user interfaces
- CO3 Identify and describe common abstract user interface components to design GUI in Java using Applet & AWT along with response to events
- CO4 Apply Servlets and JSP for creating Web based applications using JDBC
- CO5 Design and Develop various application by integrating any of Servlets, JSPs, Swing and Applet using Database

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	2	3	3	2	2
CO4	1	3	3	2	1
CO5	2	3	3	3	2

SEMESTER - I CORE - PART -	22PCSCC13: ADVANCED DATABASE MANAGEMENT SYSTEM	CREDITS: 4 HOURS: 75
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COURSE OBJECTIVES

- LO1 To understand the basic concepts and terminology related to DBMS and Relational Database Design.
- LO2 To the design and implement Distributed Databases.
- LO3 To apply normalization techniques to improve database design.
- LO4 To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports.
- LO5 Analyze a T/O based techniques for designing the database.

UNIT I

Formal review of relational database and FDs Implication – Closure - its correctness

UNIT II

3NF and BCNF -Decomposition and synthesis approaches - Review of SQL99
- Basics of query processing - external sorting -file scans

UNIT III

Processing of joins -materialized vs. pipelined processing -query transformation rules -DB transactions -ACID properties -interleaved executions – schedules -serialisability

UNIT IV

Correctness of interleaved execution -Locking and management of locks -2PL –deadlocks -multiple level granularity -CC on B+ trees -Optimistic CC

UNIT V

T/O based techniques -Multi version approaches -Comparison of CC methods - dynamic databases -Failure classification - recovery algorithm -XML and relational databases.

Text Books

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

Supplementary Readings

1. K. V. Iyer, Lecture notes available as PDF file for classroom use.

Course Outcomes

- CO1 Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.
- CO2 Know how of the file organization, Query Optimization, Transaction management, and database administration techniques.
- CO3 Elaborate the concept of Concurrency control and Failure Recovery.
- CO4 Illustrate concept of CC on B++ tree, Optimistic CC
- CO5 Use Modern database such as XML and relational databases.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	3	2	2	2
CO3	3	2	2	2	2
CO4	2	3	3	2	2
CO5	3	2	2	3	2

SEMESTER - I CORE - I PART - III	22PCSCP14: ALGORITHM LAB USING JAVA	CREDITS: 2 HOURS:
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Learning Objectives

- LO1 Implement Sorting algorithm methods
- LO2 Analyze DFS and BFS Algorithm methods
- LO3 To evaluate Back Tracking and Greedy Algorithm
- LO4 Implement Dijkstra's Algorithm
- LO5 To Develop Dynamic Programming

List of Experiments:

1. Implement Quick sort algorithm for sorting a list of integers in ascending order
2. Implement Merge sort algorithm for sorting a list of integers in ascending order.
3. Implement the DFS algorithm for a graph.
4. Implement the BFS algorithm for a graph.
5. Implement backtracking algorithm for the N-queens Problem.
6. Implement the backtracking algorithm for the Hamiltonian Circuit's problem.
7. Implement Greedy Algorithm for Job Sequencing With Deadlines.
8. Implement Dijkstra's algorithm for the Single source shortest path problem
9. Minimum cost Spanning Tree Using Prim's Algorithm.
10. Implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem

Course Outcomes

- CO1 To get Knowledge about Sorting Algorithm
- CO2 To acquire techniques about DFS and BFS Algorithmic approach
- CO3 To perform various Back track Programming techniques
- CO4 To acquire knowledge in Dijkstra's Algorithm
- CO5 To become a better knowledge in algorithm

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	3	2	2	2
CO3	3	2	2	2	2
CO4	2	3	3	2	2
CO5	3	2	2	3	2

SEMESTER - I	22PCSCP15: ADVANCED RDBMS LAB	CREDITS: 2
CORE -		HOURS:
PART -		

Learning Objectives

- LO1 To explore the features of a Database Management Systems.
- LO2 To interface a database with front end tools.
- LO3 To understand the internals of a database system
- LO4 To use of different Evaluation Plans
- LO5 To interface of Concurrency & Transactions & Big Data Analysis Using Hadoop.

List of Experiments:

1. Basic SQL
2. Intermediate SQL
3. Advanced SQL
4. ER Modeling
5. Database Design and Normalization
6. Accessing Databases from Programs using JDBC
7. Building Web Applications using PHP & MySQL
8. Indexing and Query Processing
9. Query Evaluation Plans
10. Concurrency and Transactions
11. Big Data Analytics using Hadoop

Course Outcomes

- CO1 Ability to use databases for building web applications.
- CO2 Gaining knowledge about the internals of a database system.
- CO3 To use of ER Modeling, Database Design & Normalization
- CO4 Implement the plan using Web Applications Using PHP & My SQL
- CO5 Analysis various Query Evaluation plans, Big Data Analysis

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	3	3	2	3	2
CO3	2	3	3	2	2
CO4	2	2	3	2	3
CO5	3	3	2	3	2

SEMESTER - CORE - PART -	22PCSCE16-1: COMPILER DESIGN	CREDITS: 4 HOURS: 75
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COURSE OBJECTIVES

- LO1 Discover principles, algorithms and techniques that can be used to construct various phases of compiler.
- LO2 Acquire knowledge about finite automata and regular expressions
- LO3 Learn context free grammars, compiler parsing techniques.
- LO4 Explore knowledge about Syntax Directed definitions and translation scheme
- LO5 Understand intermediate machine representations and actual code generation

Unit I

Lexical analysis -Language Processors, The Structure of a Compiler, Parameter passing mechanism – Symbol table - The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens–Finite automata-Regular expression to automata.

Unit II

Syntax Analysis - The role of the parser - Context-free grammars – Writing a grammar-Top down Parsing-Bottom-up Parsing- LR parsers-LALR parsers.

Unit III

Semantic Analysis- Inherited and Synthesized attributes –Dependency graphs–Ordering the evaluation of attributes – S-attributed definitions – L-attributed definitions – Applications of Syntax Directed translation–Syntax Directed translations schemes- Storage organization–Stack allocation of space.

Unit-IV

Intermediate Code Generation- Variants of Syntax trees–Three Address code – Types and Declarations -Translation of Expressions –Type checking-Control flow-Back patching- Switch Statements-Procedure calls.

Unit-V

Code Generation and Code Optimization - Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs–Optimization of Basic Blocks-A simple code generator–Peephole Optimization.

Text Books

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers Principles, Techniques and Tools", Second Edition, Pearson Education Asia, 2009.

Supplementary Readings

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compiler Principles, Techniques and Tools, Addison-Wesley, 2003.
2. Fischer Leblanc, Crafting Compiler, Benjamin Cummings, Menlo Park, 1988.
3. Kenneth C. Loudon, Compiler Construction Principle and Practice, Vikas publishing House, 2004.
4. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2001.
5. S. Godfrey Winster, S. Aruna Devi, R. Sujatha, "Compiler Design", yes dee Publishers, Third Reprint 2019.

COURSE OUTCOMES

- CO1 To provide sound knowledge in Lexical Analysis
- CO2 To understand the importance of context-free Grammar
- CO3 To explore knowledge in Semantic Analysis
- CO4 To know the Variants of Syntax trees
- CO5 To identify Code generations and code optimization

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	2	3	3	3	2
CO3	3	2	2	3	3
CO4	2	2	3	3	3
CO5	3	2	3	3	2

SEMESTER - CORE - PART -	22PCSCE16-2: HUMAN COMPUTER INTERACTION	CREDITS: 4 HOURS: 75
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COURSE OBJECTIVES

- LO1 To impart knowledge related to the various concepts, methods of Human Computer Interaction techniques
- LO2 Helps to Understand Interaction and Design basics
- LO3 Able to understand Design rules
- LO4 Approaches to user support Adaptive help systems – Designing user support systems.
- LO5 Implementing new ideas and users support

Unit I: The Interaction:

Introduction – Models of interaction – Frameworks and HCI Ergonomics – Interaction styles–Elements of the WIMP interface– Interactivity – The context of the interactions.**Paradigms:** Introduction–Paradigms for interaction.

Unit II: Interaction, Design basics:

Introduction – What is design? – User focus – Scenarios – Navigation design – Screen design and layout–Interaction and prototyping.

HCL in the software process: Introduction–The software life cycle–Usability engineering–interactive design and prototyping–Designrationate.

Unit III: Design rules:

Introduction– Principles to support usability – Standards – Guidelines – Golden rules and heuristics–HCI patterns.

Implementation Support: Introduction–Elements of windowing systems–Programming the application Using toolkits–User interface management systems.

Unit IV: Evaluation techniques:

What is evaluation–Goals of evaluation–Evaluation through expert analysis –Evaluation through user participation–Choosing an evaluation method.

Universal Design: Introduction – Universal design principles – Multi-modal interaction – Designing for diversity – summary. Introduction – Requirements of user support – Approaches to user support Adaptive help systems – Designing user support systems.

Unit V: User support:

Introduction Requirements of user support – Approaches to; user support – Adaptive help systems designing – designing user support systems.

Text Book

1. Human Computer Interaction, Third Edition, “Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale”, Pearson Education, 2004.

Supplementary Readings

1. Human Computer Interaction in the New Millennium, “John C. Carroll”, Pearson Education- 2002.
2. Handbook of Human-Computer Interaction, M. G. Helander, Elsevier, 2014.

COURSE OUTCOMES

- CO1 Discuss the conceptual, practical, and ethical issues involved in evaluation
- CO2 Describe what interaction design is and how it relates to human computer interaction and other fields
- CO3 Discuss the advantages and disadvantages of using analytical evaluation
- CO4 Implementing ideas in application programs
- CO5 User support system can help to designing process

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	2	2
CO2	2	3	2	3	2
CO3	3	3	2	3	3
CO4	3	2	3	2	3
CO5	3	1	3	3	3

SEMESTER - CORE - PART -	22PCSCE16-3: THEORY OF COMPUTATION I	CREDITS: 4 HOURS: 75
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COURSE OBJECTIVES

- LO1 To introduce students to the mathematical foundations of computation including automata theory
- LO2 Ability to understand the theory of formal languages and grammars.
- LO3 To Understand the notions of algorithm, decidability, complexity and computability
- LO4 To enhance Students' ability to understand and conduct mathematical proofs for computational algorithms
- LO5 To Understand Un decidable problems about turning machine

Unit I

Introduction to formal proof – Additional forms of proof– Inductive proofs –Finite Automata (FA) – Deterministic Finite Automata (DFA) –Non-deterministic Finite Automata (NFA)–Finite Automata with Epsilon transitions.

Unit II

Regular Expression– FA and Regular Expressions – Proving languages not to be regular–Closure properties of regular languages –Equivalence and minimization of Automata.

Unit III

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages–Definition of the Push down automata – Languages of a Push down Automata – Equivalence of Push down automata and CFG –Deterministic Push down Automata.

Unit IV

Normal forms for CFG–Pumping Lemma for CFL–Closure Properties of CFL–Turing Machines–Programming Techniques for TM. A language that is not Recursively Enumerable (RE).

Unit V

An undecidable problem RE–Undecidable problem about Turing Machine–Post’s Correspondence Problem–The classes P and NP.

TEXT BOOK

1. Peter Linz, “An Introduction to Formal Languages and Automata” , Third Edition , Narosa, 2005
2. J.E.Hopcroft, R.Motwani and J.D. Ullman , “ Introduction to Automata Theory , Languages and Computations ” , second Edition , Pearson Education,2007.

SUPPLEMENTARY READINGS

1. H.R.Lewis and C.H. Papadimitriou, “Elements of the theory of Computation”, Second Edition ,Pearson Education,2003.
2. Thomas A. Sudkamp,” An Introduction to the Theory of Computer Science, Languages and Machines ” , Third Edition , Pearson Education , 2007.
3. Raymond Greenlawan H . James Hoover , “ Fundamentals of Theory of Computation , Principles and Practice ” , Morgan Kaufmann Publishers , 1998.
4. Micheal Sipser, “Introduction of the Theory and Computation”, Thomson Brokecole, 1997.
5. J.Martin, “Introduction to Languages and the Theory of computation , ” Third Edition, Tata McGraw Hill,2007.

COURSE OUTCOMES

- CO1 Analyse and design finite automata, pushdown automata.
- CO2 To Analyse Turing machines, formal languages and grammars
- CO3 Demonstrate their understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.
- CO4 To Prove the basic results of the Theory of Computation
- CO5 To State and explain the relevance of the Church-Turing thesis

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	2	2
CO2	2	3	2	3	2
CO3	3	3	2	3	3
CO4	3	2	3	2	3
CO5	3	1	3	3	3

SEMESTER - II CORE - PART -	22PCSCC21: ADVANCED WEB TECHNOLOGY	CREDITS: 4 HOURS: 75
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Learning Objectives

- LO1 Explore the backbone of webpage creation by developing .NET skill.
- LO2 Enrich knowledge about HTML control and web control classes
- LO3 Provide depth knowledge about ADO.NET
- LO4 Understand the need of usability, evaluation methods for web services
- LO5 Developing Component based Programming

UNIT I

OVERVIEW OF ASP.NET - The .NET framework – Learning the .NET languages Data types – Declaring variables- Scope and Accessibility- Variable operations Object Based manipulation-Conditional Structures- Loop Structures-Functions and Subroutines. Types, Objects and Namespaces: The Basics about Classes- Value types and Reference types- Advanced class programming- Understanding namespaces and assemblies. Setting Up ASP.NET and IIS.

UNIT II

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET applications–Code behind-The Global.asax application file- Understanding ASP.NET Classes- ASP.NET Configuration. Web Form fundamentals: A simple page applet-Improving the currency converter-HTML control classes-The page class-Accessing HTML server controls. Web controls: Web Control Classes – Auto Post Back and Web Control events-Accessing web controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project- Web form Designer-Writing code-Visual studio.NET debugging. Validation and Rich Controls: Validation-A simple Validation example-Understanding regular expressions- A validated customer form. State management -Tracing, Logging, and Error Handling.

UNIT III

Working with Data- Overview of ADO.NET - ADO.NET and data management-Characteristics of ADO.NET-ADO.NET object model. ADO.NET data access: SQLbasics–Select, Update, Insert, Delete statements- Accessing data- Creating a connection- Using a command with a Data Reader - Accessing Disconnected data - Selecting multiple tables – Updating Disconnected data. Data binding: Single value Data Binding- Repeated value data binding- Data binding with data bases. Data list – Data grid – Repeater – Files, Streams and Email – Using XML.

UNIT IV

Web Services- Web services Architecture: Internet programming then and now-WSDL-SOAP-Communicating with a web service – Web service discovery and UDDI. Creating Web services: Web service basics- The Stock Quote web service – Documenting the web service-Testing the web service- Web service Data types- ASP.NET intrinsic objects. Using web services: Consuming a web service- Using the proxy class-An example with Terra Service.

UNIT V

Advanced ASP.NET- Component Based Programming: Creating a simple component-Properties and state-Database components- Using COM components. Custom controls: User Controls Deriving Custom controls. Caching and Performance Tuning: Designing and scalability-Profiling-Catching-Output catching-Data catching. Implementing security: Determining security requirements-The ASP.NET security model-Forms authentication-Windows authentication.

TextBooks

1. Mathew MacDonald, “ASP.NET Complete Reference”, TMH 2005.

Supplementary Readings

2. Crouch Matt J, “ASP.NET and VB.NET Web Programming”, Addison Wesley 2002.
3. J. Liberty, D. Hurwitz, “Programming ASP.NET” ,Third Edition, O'REILLY, 2006.

Course Outcomes

- CO1 Acquire knowledge on the concepts of .Net
 CO2 Implementing various HTML controls and Visual studio projects
 CO3 Able to develop applications using ADO .Net
 CO4 Acquire knowledge in web services
 CO5 Develop websites which contains adaptive web pages

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	2	2	2	3	3
CO3	3	3	2	3	3
CO4	3	2	3	3	3
CO5	3	1	3	3	2

SEMESTER - II CORE - PART -	22PCSCC22: DATA MINING AND BUSINESS INTELLIGENCE	CREDITS: 4 HOURS: 75
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Learning Objectives

- LO1 Demonstrate an understanding of the importance of data mining
- LO2 Understand principles of business intelligence
- LO3 Organize and prepare the data needed for data mining using pre-processing techniques
- LO4 Perform exploratory analysis of the data to be used for mining
- LO5 Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.

UNIT I

Introduction to data mining (DM): Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process- What is Business Intelligence (BI) - BI architecture and its types- What is data warehousing- Need for data warehousing - Basic elements of data warehousing – OLAP and OLTP Definitions – Difference between OLAP and OLTP.

UNIT II

Data Pre-processing: Why to pre-process data? - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.

UNIT III

Concept Description and Association Rule Mining: What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining.

UNIT IV

Classification and Prediction: What is classification and prediction? – Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods, Linear and nonlinear regression, Logistic Regression. Introduction of tools such as DB Miner /WEKA/DTREG DM Tools.

UNIT V

Data Mining for Business Intelligence Applications: Data mining for business Applications like Balanced Score card, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

Text Books

1. J. Han, Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann, 3rd Edition, 2011.
2. P. N. Tan, M. Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2018.
3. Carlo Verzellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley India Publications, 2011.
4. G. Shmueli, N.R. Patel, P.C. Bruce, Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner, 2nd Edition, Wiley India.

Supplementary Readings

1. DursunDelen, “Predictive Analytics”, Pearson Education, 2020.
2. Michael Berry and Gordon Linoff Data Mining Techniques, 2nd Edition Wiley Publications.
3. Michael Berry and Gordon Linoff Mastering Data Mining- Art & science of CRM, Wiley Student Edition.
4. VikramPudi & Radha Krishna, Data Mining, Oxford Higher Education.

Course Outcomes

- CO1 Analyse the concept of Data mining, Data Warehouse, Business Intelligence and OLAP
- CO2 Demonstrate data pre-processing techniques and application of association rule mining algorithms
- CO3 Apply various classification algorithms and evaluation of classifiers for the given problem
- CO4 Analyse data mining for various business intelligence applications for the given problem
- CO5 Apply classification and regression techniques for the given problem.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	3	2	2
CO3	3	3	3	2	1
CO4	2	3	3	3	1
CO5	2	3	3	3	2

SEMESTER - II CORE - PART -	22PCSCC23: DISTRIBUTED OPERATING SYSTEM	CREDITS: 4 HOURS: 75
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COURSE OBJECTIVES

- LO1 To study Distributed operating system concepts
- LO2 To understand hardware, software and Communication in Distributed OS
- LO3 To learn the distributed resource management components.
- LO4 Practices to learn concepts of OS and Program the principles of Operating Systems
- LO5 To Learn Linux Operating System

UNIT I

Introduction–Operating System Definition–Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem–Process Deadlock–Models of Deadlock–Conditions for Deadlock–System with single unit requests, Consumable Resources, Reusable Resources.

UNIT II

Distributed Operating Systems: Introduction-Issues–Communication Primitives – Inherent Limitations –Lamport’s Logical Clock, Vector Clock, Global State, Cuts–Termination Detection–Distributed Mutual Exclusion–Non Token Based Algorithms–Lamport’s Algorithm - Token Based Algorithms –Distributed Deadlock Detection– Distributed Deadlock Detection Algorithms – Agreement Protocols

UNIT III

Distributed Resource Management – Distributed File Systems – Architecture–Mechanisms–Design Issues – Distributed shared Memory–Architecture–Algorithm–Protocols–Design Issues–Distributed Scheduling–Issues–Components–Algorithms.

UNIT IV

Failure Recovery and Fault Tolerance– Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems–Synchronous and Asynchronous Check pointing and Recovery– Check pointing in Distributed Database Systems–Fault Tolerance Issues – Two-Phase and Non blocking Commit Protocols –Voting Protocols–Dynamic Voting Protocols.

UNIT V

Multi processor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling –Memory management–Reliability/Fault Tolerance – Database Operating Systems–concepts–Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

Text Books

- 1.Mukesh Singhal N.G.Shivaratri, “Advanced Concepts in Operating Systems”, McGraw Hill 2000.
- 2.Distributed Operating System–Andrew S. Tanenbaum, PHI.

Supplementary Readings

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne “OperatingConcepts”,6th Edition Addison Wesley publications2003.
2. AndrewS.Tanenbaum,“Modern Operating Systems”,2nd Edition Addison Wesley 2001.

Course Outcomes

- CO1 Acquire knowledge on the concepts advanced operating system and approaches
- CO2 Implementing Lamport’s Algorithm - Token Based Algorithms –Distributed Deadlock Detection Algorithm
- CO3 Gaining knowledge Distributed Resource Management– Distributed File Systems
- CO4 Acquire knowledge in Failure Recovery and Fault Tolerance
- CO5 To know the Features of Android OS, Ubuntu, Google ChromeOS and Linux operating systems.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	1
CO2	2	3	1	3	2
CO3	3	2	2	3	3
CO4	3	3	3	3	3
CO5	3	2	3	3	3

SEMESTER - II	22PCSCP24: ADVANCED WEB TECHNOLOGIES LAB	CREDITS: 2
CORE -		HOURS: 75
PART -		

COURSE OBJECTIVES

- LO1 Create simple Web service Programs
- LO2 Develop windows application based web services
- LO3 Accessing Database in Web services
- LO4 To create an application that simulates sending a SOAP message
- LO5 Develop a Web intranet/internet based Web Service Client

List of Experiments:

1. Create a simple Web Service that converts the temperature from Fahrenheit to Celsius and vice versa.
2. Use the above Web Service on a webpage and execute to fetch the results
3. Create a Web Services provider and make it available on the Internet or intranet.
4. Create a web based Consumer of an existing web service.
5. Create a Windows application based consumer of an existing web service.
6. Write an application that simulates sending a SOAP message as a request and receiving another as a response.
7. Develop a Web Service that provides images as responses.
8. Develop a web service that access table contents of a database.
9. Develop a console based Web Service Client.
10. Develop a Web intranet/internet based Web Service Client.

Course Outcomes

- CO1 Acquire Excellent knowledge and execute simple web service programs
- CO2 Implementing various techniques in web services
- CO3 Able to develop applications based web services from existing programs
- CO4 Using SOAP techniques
- CO5 Develop Client server based web Services

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
C01	3	2	2	2	2
C02	2	1	2	3	2
C03	3	2	1	3	3
C04	3	2	3	1	3
C05	3	2	3	3	2

SEMESTER - II CORE - PART -	22PCSCP25: DATA MINING LAB USING R	CREDITS: 2 HOURS: 75
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COURSE OBJECTIVES

- LO1 To introduce the concept of data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.
- LO2 To enable students to effectively identify sources of data and process it for data mining.
- LO3 To learn how to gather and analyze large sets of data to gain useful business understanding through the R language.
- LO4 To impart skills that can enable students to approach business problems.
- LO5 To analytically identifying opportunities to derive business value from data.

List of Experiments:

1. Introductory commands in R
2. Programs using Descriptive Statistics.
3. Program to demonstrate pre-processing on dataset Mtcars
4. Program to demonstrate Association rules on Groceries dataset using Apriori Algorithm
5. Program to demonstrate Classification Rules process on dataset Titanic using id3 Algorithm.
6. Program to demonstrate Classification rule process on dataset Titanic using CART Algorithm.
7. Program to demonstrate Classification rule process on Breast Cancer dataset using Naïve Bayesian Algorithm.
8. Program to demonstrate Clustering rule process on dataset Iris using simple K-Means.
9. Program to demonstrate Clustering rule process on dataset Iris using Hierarchical Clustering.
10. Program to demonstrate Outlier Detection using dataset Iris.

Course Outcomes

- CO1 Use different features of R Programming language
- CO2 Preprocess the data for mining for any dataset.
- CO3 Determine association rules.
- CO4 Model the classifiers for classifying various dataset.
- CO5 Examine clusters from the available data.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	1	2	2	3	3
CO2	2	2	3	3	2
CO3	1	3	3	1	2
CO4	1	3	3	2	2
CO5	2	3	3	2	2

SEMESTER - CORE - PART -	22PCSCE26-1: CRYPTOGRAPHY AND NETWORK SECURITY	CREDITS: 4 HOURS: 75
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Learning Objectives

- LO1 To understand basics of Cryptography and Network Security.
- LO2 To be able to secure a message over in secure channel by various means
- LO3 To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- LO4 To understand various protocols for network security to protect against the threats in the networks.
- LO5 To Understand Intruders and detection Techniques

Unit I

Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

Unit-2

Symmetric Encryption and Message Confidentiality – Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

Unit-3

Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

Unit-4

IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.

Unit-5

Intruders - Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Counter measures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

Text Books:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, (2007) , Reprint (2015).
2. Stallings William, "Cryptography and Network Security-Principles and Practice (2017).
3. WilliamStallings, "Network Security Essentials Applications and Standards", Third Edition, Pearson Education, (2008).

Supplementary Readings

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms And Protocols", Wiley Publications, (2003).
2. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall Of India, (2006).
3. Ulysess Black," Internet Security Protocols",Pearson Education Asia,(2000).
4. Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security,Second Edition, Private Communication In Public World", PHI(2002).
5. Bruce Schneier And Neils Ferguson, "Practical Cryptography",First Edition,Wiley Dreamtech India Pvt Ltd,(2003).
6. Douglas R Simson, "Cryptography–Theory and Practice", First Edition, CRC Press, (1995).

Course Outcomes

- CO1 Provide security of the data over the network.
- CO2 Do research in the emerging areas of cryptography and network security.
- CO3 Implement various networking protocols.
- CO4 Protect any network from the threats in the world.
- CO5 To protect from intruders and Virus Threats

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	3	2	2
CO3	3	3	2	3	2
CO4	3	3	2	3	2
CO5	3	3	3	2	2

SEMESTER - CORE - PART -	22PCSCE26-2: OPEN SOURCE COMPUTING	CREDITS: 4 HOURS: 75
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Learning Objectives

- LO1 To understand the features of PHP
- LO2 To develop the different applications using PHP
- LO3 To demonstrate the applications using PHP with Mysql
- LO4 To understand the concepts of Perl
- LO5 To develop the applications using Perl

Unit I: BASIC PHP

Web Server-Apache-PHP-Data Types-User defined Variables-Constants-Operators-Control Structures-User defined Functions-Directory Functions-File system Functions-Arrays-String Functions-Date and Time Functions-Mathematical Functions-Miscellaneous Functions.

UNIT II: ADVANCED PHP WITH MYSQL

Exceptions handling-Error Handling Functions-Predefined Variables- Cookies - Sessions-COM-DOM-CURL-SOAP-Classes and Objects-Mail Function-URL Functions. PHP with MySQL:PHP MySQL Functions-Database driven application.

UNIT III: ADVANCED PHP WITH AJAX, SEO AND CMS PHP WITH AJAX

Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Word press Creating an SE-Friendly Blog.

UNIT IV: BASIC PERL

Introduction-Scalar Data-Lists and Arrays-Subroutines-Input and Output-Hashes-Regular Expressions-Control Structures-Perl Modules-File Tests

UNIT V: ADVANCED PERL

Directory Operations-Strings and Sorting-Smart Matching-Process Management-Advanced Perl Techniques

Text books

1. Mehdi Achour, Fried helm, Betz Antony Dovgal, Nuno Lopes, Hannes Magnusson, Georg Richter, Damien Seguy, Jakub Vrana and several others, “ PHP Manual (Download the manual from PHP official website www.php.net)”, 1997-2011 the PHP Documentation Group.
2. LeeBabin, “Beginning Ajax with PHP From Novice to Professional ” , Apress , 2007 (Chapters 1, 2, 3 and 4) Jaimie Sirovich and Cristian Darie, “Professional Search Engine Optimization with PHP A Developer’s Guide to SEO”,Wiley Publishing ,Inc., Indian apolis, Indiana, 2007 (Chapters2,3,5and16)

3. Randal L. Schwartz, Tom Phoenix, brian d foy, "Learning Perl, Fifth Edition Making Easy Things Easy and Hard Things Possible ", O'Reilly Media , June 2008

Supplementary Readings

1. Steven D.Nowicki, Alec Cove, Heow Eide goodman,"Professional PHP", WroxPress, 2004.

Course Outcomes

- CO1 Students are able to understand the features of PHP
- CO2 Students are able to develop the different applications using PHP
- CO3 Students are able to demonstrate the applications using PHP with Mysql
- CO4 Students are able to understand the concepts of Perl
- CO5 Students are able to develop the applications using Perl

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	2	2	3	2
CO3	2	2	3	2	3
CO4	2	3	2	3	3
CO5	3	2	2	3	2

SEMESTER - I CORE - I PART - III	22PCSCE26-3: SOFT COMPUTING	CREDITS: 4 HOURS: 75
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Learning Outcomes

- LO1 Familiarize with soft computing concepts
- LO2 Introduce and use the idea of fuzzy logic and use of heuristics based on human experience.
- LO3 Familiarize the Neuro-Fuzzy modeling using Classification and Clustering techniques.
- LO4 Learn the concepts of Genetic algorithm and its applications
Acquire the knowledge of Rough Sets.
- LO5 Introduce students to Bi-directional Associative Memory.

UNIT I Introduction to Soft Computing

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II Artificial Neural Networks

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks-Support Vector Machines - Spike Neuron Models.

UNIT III Fuzzy Systems

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV Genetic Algorithms

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction -Inheritance Operators - Cross Over - Inversion and Deletion - Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT V Hybrid Systems

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy Art Map: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

Text Books:

1. Soft Computing – Advances and Applications – Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning.

Supplementary Readings

1. S. N. Sivanandam & S. N. Deepa, “Principles of Soft Computing”, 2nd edition, Wiley India, 2008.
2. David E. Goldberg, “Genetic Algorithms-In Search, optimization and Machine learning”, Pearson Education.
3. J. S. R. Jang, C.T. Sun and E. Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education, 2004.
4. G.J. Klir & B. Yuan, “Fuzzy Sets & Fuzzy Logic”, PHI, 1995.
5. Melanie Mitchell, “An Introduction to Genetic Algorithm”, PHI, 1998.
6. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill International editions, 1995.

Course Outcomes

- CO1 Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
- CO2 Understand fuzzy logic and reasoning to handle and solve engineering problems..
- CO3 Apply the Classification and clustering techniques on various applications.
- CO4 Understand the advanced neural networks and its applications.
- CO5 Perform various operations of genetic algorithms, Rough Sets. Comprehend various techniques to build model for various applications.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	2	2	2	3	2
CO3	2	3	3	2	3
CO4	2	2	3	3	3
CO5	3	2	2	3	2