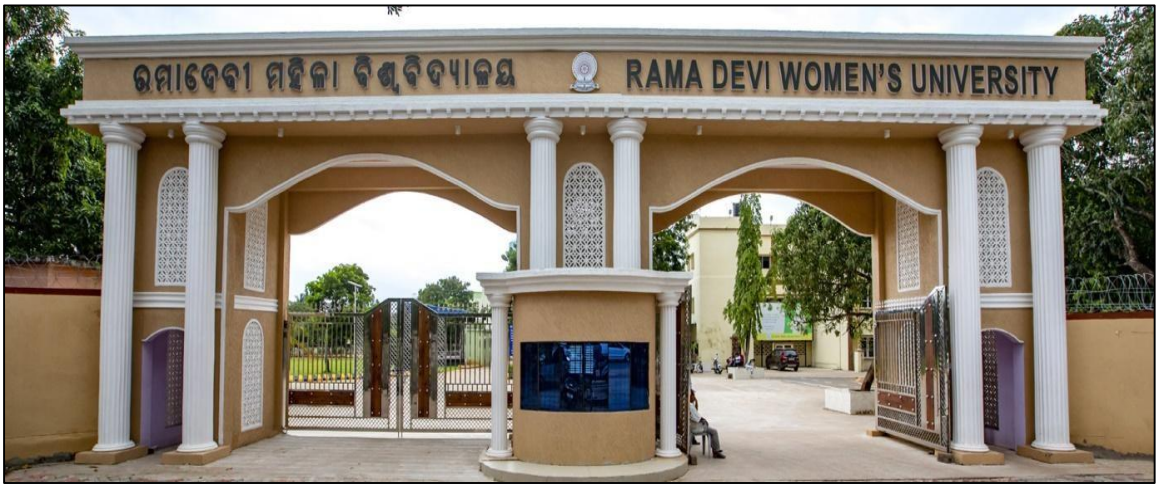
DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF PG PROGRAMME (M.Sc.)



RAMA DEVI WOMEN'S UNIVERSITY
Vidya Vihar, Bhubaneswar-751022, Odisha
Website: https://rdwu.ac.in

RAMA DEVI WOMEN'S UNIVERSITY

Syllabus

for

Masters in Science, Computer Science

(2-YearsProgramme)

P. G. DEPARTMENT OF COMPUTER SCIENCE
RAMA DEVI WOMEN'S UNIVERSITY
VIDYA VIHAR, BHUBANESWAR-751022

2022-23

21.10.23
Controller of Examinations
R.D. Women's University
Bhubaneswar

DEPARTMENT OF COMPUTER SCIENCE (W.E.F.2022-23)

RAMA DEVI WOMEN'S UNIVERSITY

PG SYLLABUS STRUCTURE

Semester-I								
Sl. No.	**Nature of Course**	**Course Code**	**Paper Title**	**Units**	**Credits**	**Marks**		
						Mid-Sem.	**End-Sem.**	**Total**
1	Hard Core	HC-101	Discrete Mathematical Structure	5	5	30	70	100
2	Hard Core	HC-102	Computer System Architecture	5	5	30	70	100
3	Hard Core	HC-103	Database Systems Implementation	5	5	30	70	100
4	Hard Core	HC-104	a) Database Systems Practical b) Python Practical	--	5	30	70	100
5	Allied Core	AC-101	Computer Applications in Teaching Learning (Course to be offered by e-learning center)	3	3	Mid-Sem 10+ Practica1 10= 20 marks	30	50
	Total				**23**	**140**	**310**	**450**

Semester-II								
Sl. No.	**Nature of Course**	**Course Code**	**Paper Title**	**Units**	**Credits**	**Marks**		
						Mid-Sem.	**End-Sem.**	**Total**
6	Hard Core	HC-201	Data structure & Algorithm	5	5	30	70	100
7	Hard Core	HC-202	Operating Systems	5	5	30	70	100
8	Hard Core	HC-203	Theory of Computation	5	5	30	70	100
9	Hard Core	HC-204	a) Data Structure & Algorithm Practical b) Operating System Practical	--	5	30	70	100
10	Core Elective	CE-201	Artificial Intelligence **OR** Data Science	5	5	30	70	100
11	Open Elective	OE-201	E-Commerce **OR** MOOCs (From SWAYAM/ NPTEL etc.)	--	4	--	50	50
	Total				**29**	**150**	**400**	**550**

Semester-III								
Sl. No.	**Nature of Course**	**Course Code**	**Paper Title**	**Units**	**Credits**	**Marks**		
						Mid-Sem.	**End-Sem.**	**Total**
12	Hard Core	HC-301	Computer Networks	5	5	30	70	100

13	Hard Core	HC-302	Software Engineering	5	5	30	70	100
14	Hard Core	HC-303	a) Computer Networks Practical b) Software Engineering Practical	--	5	30	70	100
15	Core Elective	CE-301	Compiler Design **OR** Graph Theory	5	5	30	70	100
16	Core Elective	CE-302	Cloud Computing **OR** Soft Computing	5	5	30	70	100
17	Field Internship	FI-201	Field Internship	--	3	--	50	50
	Total				**28**	**150**	**400**	**550**

Semester-IV								
Sl. No.	**Nature of Course**	**Course Code**	**Paper Title**	**Units**	**Credits**	**Marks**		
						Mid-Sem.	**End-Sem.**	**Total**
18	Hard Core	HC-401	Applied Cryptography	5	5	30	70	100
19	Hard Core	HC-402	a) Java Practical b) Applied Cryptography Practical	--	5	30	70	100
20	Hard Core	HC-403	Dissertation	--	5	--	100	100
21	Core Elective	CE-401	Data Mining **OR** Internet of Things	5	5	30	70	100
22	Allied Core	AC-401	Women and Society (For All PG Subjects/ Programs)	3	3	15	35	50
	Total				**23**	**105**	**345**	**450**

Summary

HC-Hard Core	14 x100	1400
CE-Core Elective	4 x100	400
OE-Open Elective	1x50	50
AC-Allied Core	2x50	100
FI-Field Internship	1x50	50
Total Marks:		**2000**

Summary

Semester	**Credits**	**Total Marks**
Sem-I	23	450
Sem-II	29	550
Sem-III	28	550
Sem-IV	23	450
TOTAL	**103**	**2000**

DEPARTMENT OF COMPUTER SCIENCE
Rama Devi Women's University, Bhubaneswar

M.Sc. Computer Science

Programme Outcomes (POs)

After completion of the course, the student will achieve the following:

PO1.Engineering knowledge: Apply the knowledge of mathematics, science, and computer science specialization to evaluate, analyse, synthesize, model and integrate technologies to solve complex scientific problems.

PO2.Problem analysis: Analyse complex scientific problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical and practical context.

PO3.Design/development of solutions: Design and develop a system to provide a wide range of potential, feasible and optimal solutions for critical and challenging scientific problems to meet the desired needs within social areas such as economics, environmental, and ethics.

PO4.Conduct investigations of complex problems: Research skill to extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of Science.

PO5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modelling to complex scientific activities with an understanding of the limitations.

PO6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

PO7.Environment and sustainability: Understand contemporary issues in providing technology solutions for sustainable development considering impact on economic, social, political, and global issues and thereby contribute to the welfare of the society.

PO8.Ethics: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO9.Individual and team work: Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and team work ,decision-making based on

open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO10.Communication: Communicate with the science community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economic and financial factors.

PO12.Life-long learning: Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

Programme Specific Outcomes (PSOs)

A graduate with a M.Sc. in Computer Science will have the ability to

PSO1. Communicate computer science concepts, designs, and solutions effectively and professionally.

PSO2. Apply knowledge of computing to produce effective designs and solutions for specific problems.

PSO3. Use software development tools, software systems, and modern computing platforms.

DETAIL SYLLABUS

HC-101 DISCRETE MATHEMATICAL STRUCTURE

Course Outcomes

- Upon successful completion of this course, students will be able to:
- **CO1.** Apply mathematical logic to solve problems and prove theorems.
- **CO2.** Understand sets, relations, functions and discrete structures.
- **CO3.** Solve counting problems by applying counting techniques, permutations, combinations, pigeonhole principle.
- **CO4.** Learn various concepts of graph theory and apply to real world problems.
- **CO5.** Understand the algebraic structure: Group, Ring, Field.

UNIT I

Propositional Logic, Propositional equivalences, Rules of Inference for Propositional Logic. Predicates and Quantifiers, Nested Quantifiers, Rules of Inference for Quantified Statements. Methods of Proof: Direct Proofs, Proof by Contraposition, Proofs by Contradiction.

UNIT II

Sets, Set Operations, Set Identities. Functions, One-to-One and Onto Functions, Inverse Functions and Compositions of Functions. Relations, Properties of Binary Relations, Composition of Relations, Equivalence Relations, Equivalence Classes and Partitions, Partial Orderings, Chain, Hasse Diagrams, Lattices.

UNIT III

Mathematical Induction, Strong Induction. The Basics of Counting, Principle of Inclusion-Exclusion, The Pigeonhole Principle. Permutations and Combinations.

UNIT IV

Introduction to Graphs, Graph Terminology, The Handshaking Theorem, Special Simple Graphs (Complete Graphs, Cycles, Wheels, Bipartite Graphs). Representing graphs, Graph Isomorphism.
Euler Paths and Circuits, Hamilton Paths and Circuits, Planar Graphs, Euler's Formula for Planar Graphs.

UNIT V

Groups, Subgroups, Cosets and Lagrange's Theorem. Codes and Group codes.
Ring, Integral Domains and Fields.

Text Books

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGrawHill International.
2. C.L. Liu, "elements of Discrete Mathematics", McGraw Hill International

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Mapping of Course Outcomes with the Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	5	5	4	4	1	4	1	1	1	1	1	2
CO2	5	4	4	2	1	1	1	1	1	1	1	2
CO3	5	4	4	2	1	1	1	1	1	1	1	2
CO4	5	4	5	4	2	1	1	1	1	1	1	2
CO5	4	4	4	2	1	1	1	1	1	1	1	2

HC-102 COMPUTER SYSTEM ARCHITECTURE [30+70=100]

Course Outcome

- CO 1:Understand the advanced concepts of computer architecture.
- CO 2:Analyze to the major differentials of RISC and CISC architectural characteristics.
- CO 3: Investigate modern design structures of Pipelined and Multiprocessors systems.
- CO 4: Acquainted with recent computer architectures and I/O devices, as well as the low-level language required to drive/manage these types of advanced hardware.
- CO 5: prepare selected reports that imply some emergent topics supporting material essence.

UNIT I

Computer Function and Interconnection: Computer Components, Computer Function. Interconnection Structures, Bus Interconnection, PCI,
Cache Memory: Computer Memory System, Cache Memory Principles, Elements of Cache Design.Pentium-4 Cache Organization.

UNIT II

External Memory: Magnetic Disk, RAID, Optical Memory, Magnetic Tape, External Devices. I/O Module, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access.
I/O Channels and Processors, Fire Wire and InfiniBand.

UNIT III

CPU Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining.

Reduced Instruction Set Computer (RISC): Instruction Execution Characteristics, Use of a large Register File,Compiler-BasedRegisterOptimization,ReducedInstructionSetArchitecture,RISCPipelining,
MIPS R4000, SPARC, RISC Versus CISC Controversy.

UNIT IV

Instruction Level Parallelism and Superscalar Processors, Overview and Design Issues of Pentium-4. IA-64 Architecture: Motivation, General Organization, Prediction, Speculation, and Software Pipelining. IA-64 Instruction Set Architecture, Itanium Organization.

UNIT V

Parallel Organization: Multiple Processors Organizations, Symmetric
Multiprocessors, Cache Coherence and MESI Protocol.
Clusters, Non-Uniform Memory Access (NUMA), Vector Computation.

Text Books

1. Stalling W. Computer Organization and Architecture**.** (PHI)
2. C. Hamacher G. Vranesic, S. Zaky – Computer Organization McGraw Hill1996

References

1. M. M. Mano – Computer System Architecture, 3rd Edition, PHI1993
2. K. Hwang – Advanced Computer Architecture, McGraw Hill,1993

CO-PO Mapping Table

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	5	5	4	4	4	1	1	1	1	4	1	1
CO 2	5	5	4	5	5	1	1	1	4	1	1	1
CO 3	4	5	5	5	5	1	1	1	4	4	1	1
CO 4	5	5	5	5	5	1	1	1	4	4	1	1
CO 5	5	5	5	5	5	1	1	1	5	1	4	1

HC-103 DATABASE SYETEMS IMPLEMENTETAION

Course outcomes:

CO1: Analyse application data using E-R modelling and describe the logical and physical database designs.
CO2: Understand relational algebra, calculus and apply structured query language (SQL) for database definition and manipulation.
CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4: Use transaction management systems
CO5: Use Concurrency Control methods and apply security on database systems.

UNIT I:

Introduction to Database, 3-Schema Architecture and Data independence, Schema, and instances. Conceptual Modeling and Database Design: Entity Relationship (ER) Model: Entity Types, Entity sets, Attributes, keys, Relationship types, Relationship Sets, Roles and structural constraints, Weak entity types, Refining the ER design for the company database, ER diagram Naming conventions and design issues.
ER to relational mapping and Enhanced Entity-Relationship (EER) and object modeling subclasses.

UNIT II:

Relational Algebra and Calculus: Relational Algebra operations, Tuple relational calculus, Domain relational calculus. SQL- The Relational Database Standard: Data Definition, Constraints and schemas, Insert, Delete and Update statement in SQL. SQL queries: Basic and complex SQL queries, Aggregate functions.

UNIT III:

Database Design Theory: Functional Dependencies, Armstrong's Axioms. Closure of attributes, Dependency preservation, Lossless design. Normalization: Normal Forms on Primary Keys, Second and third Normal Forms, Boyce-Codd Normal Form.

UNIT IV:

Query processing and Optimization: Translating SQL queries into relational algebra, Basic

diagram for executing query operations, Using Heuristics in query optimization. Transaction processing concepts: Introduction, Transaction and system concepts, Desirable properties of transaction.
Schedules and recoverability: Types of Schedule, Serializability of schedules, Checking serializability of schedules.

UNITV:

Concurrency Control Techniques: Locking techniques for concurrency control, Concurrency control based on time stamp ordering, Multi version concurrency control techniques, Validations concurrency control techniques. Database Security and Authorization: Introduction to database security issues, Discretionary access control based on granting and revoking privileges, Mandatory access control for multilevel security.
Distributed Database Systems: Client Server architecture, Distributed database concepts, Data fragmentation, Replication and allocation technique for distributed database, Types of distributed database systems.

Text Books

1. RamezElmasri and Shamkant B. Navathe, *"Fundamentals of Database Systems"*, Pearson Education, 7th Ed.,2016.
2. Rajeeb C. Chatterjee, *"Learning Oracle SQL and PL/SQL: A simplified Guide",* PHI Learning Private Limited,2012.

Reference Books

1. A.Silberschatz,H.F.Korth,S.Sudarshan,*"DatabaseSystemConcepts",*McGrawHill,7thEd.,2021.
2. Raghu Ramakrishnan and Johannes Gehrke, *"Database Management Systems",* McGraw Hill, 3rd Ed., 2014.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	5	4	4	1	1	1	1	1	1	1	1
CO2	5	1	4	1	1	1	1	1	1	1	1	1
CO3	4	1	4	1	1	1	1	1	1	1	1	4
CO4	4	1	1	1	4	1	1	1	2	2	4	4
CO5	4	1	1	1	4	1	1	1	2	2	2	4

HC -104 Database System & Python Practical

(a) Database Systems Practical
(b) Python Practical

Course Outcomes

Upon successful completion of this course, students will be able to:

CO 1: Ability to understand the various kinds of SQL commands

CO 2:Demonstrate the operation on database table.

CO 3:Ability to make customized query efficiently on a database.

CO 4:Ability to apply query techniques for realistic data.

CO 4:Write, test, and debug simple Python programs.

CO 5: Ability to understand Python code, develop medium difficulty applications in Python

List of Experiments

a) Database System Practical

1. Creating/Altering/Deleting Tables.
2. Retrieving data using SQL Queries.
3. Creating tables with constraints.
4. Working on Multiple tables with join.
5. WAP a PL/SQL program to find the factorial of a number.
6. WAP a PL/SQL program to print the Fibonacci series upto n terms.

b) Python Practical

1. WriteapythonprogramtoconverttemperaturefromCelsiustoFahrenheitandviceversa
2. Write a python program to find largest of three numbers.
3. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem).
4. Write a python program to print prime numbers less than100.
5. Write a python program to find factorial of a number using recursion.
6. Create a list and perform the following methods
   a) insert()
   b) remove()
   c) append()
   d) len()
   e) pop()
   f) clear()

PO-CO Mapping Table

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	5	5	5	2	2	1	1	1	1	1	1	5
CO 2	5	5	5	2	2	1	1	1	1	1	1	5
CO 3	5	5	5	2	2	1	1	1	1	1	1	5
CO 4	5	5	5	2	2	1	1	1	1	1	1	5
CO 5	5	5	5	2	2	1	1	1	1	1	1	5

HC-201 SEMESTER-II DATA STRUCTURE & ALGORITHM

Course Outcomes

Upon successful completion of this course, students will be able to:

CO1. Analyze the efficiency of algorithms using asymptotic notations, apply divide-and-conquer method to design algorithms, and solve recurrences.

CO2. Use standard data structures like hash tables, heaps, and trees to store data efficiently.

CO3. Explain major graph algorithms and apply these algorithms to solve real world problems.

CO4. Design and analyze algorithms using greedy technique and dynamic programming.

CO5. Understand complexity classes P, NP, co-NP, NP-hard, NP complete and NP complete reductions.

UNIT I

Introduction to algorithms, Analysis of Insertion sort. Asymptotic Notations, Divide and Conquer Approach, Merge Sort, Recurrence Relations. Solving Recurrences: Substitution methods, Recursion tree method, and Master method.

UNIT II

Quick Sort, Heap Sort. Hash Tables, Hash Functions, Chaining, Open Addressing: Linear probing, Quadratic probing and Double hashing Binary search trees, AVL tree, B-trees.

UNIT III

Representation of Graphs, Breadth-First Search, Depth-First search, Topological sort, Minimum spanning trees: Prim's and Kruskal's Algorithm.Single source shortest paths: The Bellman-Ford algorithm, Dijkstra's algorithm.

UNIT IV

Dynamic programming: Matrix Chain multiplication, Longest Common Subsequence.
Greedy algorithms: Activity selection problem, Human codes.
Amortized analysis: Aggregate Analysis, The Accounting Method, The Potential Method.

UNIT V

Decision Problems vs. Optimization Problems, Polynomial time, Polynomial-time Verification, Polynomial-time Reduction

Complexity Classes: P, NP, co-NP, NP-hard and NP-complete. Example of NP-Complete Problems (Satisfiability problem, 3-CNF satisfiability problem, Clique problems, Vertex cover problem, Hamiltonian cycle problem, Travelling salesman problem).

NP-Completeness proofs: Clique to vertex cover problem reduction, Hamiltonian cycle to Travelling salesman problem reduction.

Text Books

1. Introduction to Algorithms, T.H. Corman, C.E.Leiserson, R.L.Rivest and C.Stein
2. Algorithm Design, Jon Kleinberg, ÉvaTardos.

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Mapping of Course Outcomes with the Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	5	5	4	4		1	1	1	1	1	1	2
CO2	4	4	4	4	2	1	1	1	1	1	1	2
CO3	5	4	5	5	2	1	1	1	1	1	1	2
CO4	5	5	5	5		1	1	1	1	1	1	2
CO5	5	5	4	5	2	1	1	1	1	1	1	2

HC-202 OPERATING SYSTEMS

Course Outcomes

CO1: Analyze the concepts of Operating System.
CO2: Analyze the concepts of process, thread and deadlock situation and Illustrate the Scheduling of a processor for a given problem instance.
CO3: Analyze memory management techniques and implement page replacement Algorithm.
CO4: Understand the implementation of file systems and directories.
CO5: Understandtheimplementationof files system using UNIX operating system.

UNIT-I

Introduction: Definition of OS, History of DOS and UNIX Operating
System Process: Definition of Process, Process States.
Deadlock: Definition of Deadlock, Causes of Deadlock, Avoidance of Deadlock, and Recovery from Deadlock.

UNIT-II

Processor management: Preemptive versus non-preemptive scheduling - priorities -deadline scheduling - FIFO - RR -SJF
Distributed computing: Classification of sequential and parallel processing-array processors. Dataflow computers - multiprocessing - fault tolerance.

UNIT-III

MemoryManagement:Background,LogicalversusPhysicalAddressspace,swapping,contiguousAllocation. Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging.
Page Replacement: Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

UNIT-IV

Device and information management: Operation of moving head disk storage - need for disk scheduling. Optimization - FCFS - SSTF - SCAN - RAM disks - optical disks.
Files and database systems: File system - function - organization - allocating and freeing space - file descriptor - access control matrix.

UNIT-V

Case studies: DOS - memory management - overlaying - extended and expanded memory - memory allocation.
File system and allocation method - internal and external command memory management functions - file management functions.
UNIX: Process in UNIX - memory management - I/O systems - file systems and allocation method.

Text Book

1. Willam Stallings, "Operating Systems", 5/e PHI/Pearson Education.
2. Silberschatz, Peterson, Galvin, "Operating System Concepts", Addisson Wessely, Fifth Edition,
3. H. M. Deital, “An introduction to operating systems”, Addison Wisely,

References

1. Charles Crowley, "Operating systems - A Design Oriented Approach", Tata McGrawHill.
2. Andrew S. Tannenbaum, "Operating Systems: Design and Implementation", PHI,2006.
3. Mukeshsinghal, Niranjan G shivaratri, “Advanced concepts in operating systems”,MGH.

Mapping of Course Outcomes with the Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	4	2	5	4	4	2	1	1	1	1	1	1
CO2	5	4	4	4	4	2	1	1	1	1	1	1
CO3	4	4	5	5	2	2	1	1	1	1	1	1
CO4	4	5	5	5	2	2	1	1	1	1	1	1
CO5	2	5	4	5	2	2	1	1	1	1	1	1

HC-203 THEORY OF COMPUTATION

COURSE OUTCOMES:

After completion of the course, a student will be able to

CO 1 Describe the concept of abstract machines and their power to recognize the languages.
CO 2 Apply finite state machines for modelling and solving computing problems.
CO 3 Design context free grammars for formal languages.
CO 4 Distinguish between decidability and undesirability.
CO 5 Solve mathematical tools and formal methods
CO 6 Apply mathematical and formal techniques for solving problems in computer science

UNIT-I:

Background materials: Alphabets, Strings, Empty Strings, Sets, Empty Set,
Proof Methods: Induction, Contradiction, Hypothesis
Introduction to Theory of Computation: Finite State Machine, Deterministic Finite Automata, Non- deterministic Finite Automata, Equivalence of NFA and DFA, Minimization of Finite state Machine

UNIT-II:

Regular Expressions and Languages: Introduction, Conversion of DFAs to Regular Expressions, and Vice versa, Pumping Lemma
Closure Properties of Regular Languages: Union, Intersection, Complement, Difference, Reversal, Homomorphism, and Inverse Homomorphism.
Context Free Languages: Context Free Languages, Context Free Grammars, Derivation, Ambiguity,

UNIT-III:

Push Down Automata: Definition of PDAs, Acceptance of PDAs by final state and by empty stack, Conversion of CFG to PDA and vice versa, DPDA and NPDA
Simplification of CFG: Chomsky Normal Form, Greibach Normal Form. The Pumping Lemma for CFL's. Closure properties CFL.
Turing Machines: TM Definition and Notation, Instantaneous Descriptions, NTM & DTM, Extensions and Restrictions to Basic TM Model: Multi Tape, Multi Dimensional, Counter machine, Two StackPDAs.

UNIT-IV:

Decidability Theory: The Church-Turing Thesis, Universal Turing Machines and TM Encoding, Decidable and Semi-decidable languages: Recursive Enumeration and Decidability, Many-one Reductions, Hardness, Undecidability

Language Properties: Closure Properties, The Diagonalization Language, The Halting Problem, Post's Correspondence Problem, Undecidable Problems from Language Theory, Linear Bounded /automata (LBA).

UNIT-V:

omplexity Theory: Measuring Complexity, The O, Ω, Θ notations Time
Complexity classes: P, NP, NP – Completeness,
Some NP-Complete Problems: SAT, 3-SAT, Hamiltonian Path, Vertex Cover, Independent Set, Space Complexity classes: PSPACE, L, NL.

Text Book

1. Introduction to Automata Theory, Languages& Computation – Hopcroft, Motwani& Ullman.
2. Introduction to Theory of Computation: M.Siper, ThompsonLearning

Reference Book

1. Fundamental of the theory of Computation ,Priciples and Practice- R.Greenland,H.J.Hoorer.
2. K.L.P. Mishra and N. Chandrasekaran, Theory of Computer Science,PHI.
3. Michael Sipser, Introduction to the Theory of Computation, ThomsonLearning.

CO-PO-PSOMAPPING

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3	PSO 4
AEC3.1	5	1	1	1	1	1	1	1	1	1	1	1	1	4	1	4
AEC3.2	1	5	1	4	1	1	1	1	1	1	1	1	4	5	4	1
AEC3.3	1	1	4	5	1	1	1	1	1	1	1	1	4	5	4	5
AEC3.4	2	4	4	1	5	1	1	1	1	1	1	1	1	4	4	5
AEC3.5	2	1	1	1	5	1	1	1	1	1	1	1	5	1	5	1
AEC3.6	1	5	1	4	1	1	1	1	1	1	1	1	1	1	1	4
AEC3	2	4		4	1	1	1	1	1	1	1	1	4	4	4	4

HC-204 Data Structure & Operating System Lab

(a) Data Structure &Algorithm Practical

(b) Operating System Practical

Course Outcomes

Upon Completing the Course, Students will able to

- CO 1: For a given sorting problem (Merge/Insertion/Quick) student will able to implement it and analyze the same to determine the time and computation Complexity.
- CO 2:Student will able to implement program for Graph traversal Algorithm & Hashing Technique.
- CO 3:Implements various OS Scheduling Algorithms.
- CO 4: Implements various Memory Scheduling Algorithms
- CO 5:Emphasize hands-on experience working with various algorithm associated with Data Structure and Operating Systems

List of Experiments

a) Data Structure &Algorithm

1. WAP in C to implement Quick Sort
2. WAP in C to implement Insertion Sort
3. WAP in C to implement Merge Sort
4. WAP in C to implement Binary Search Tree
5. WAP in C to implement Shortest Path Method (Dijkstra's Method)
6. WAP in C to implement Implementing Hashing (Linear &Quadratic)

b) Operating System Practical

1. Implementing FCFC Scheduling.
2. Implementing SJFS scheduling.
3. Implementing Priority Scheduling.
4. To Simulate MFT Memory Management Technique
5. To Simulate Memory Management Technique
6. To Simulate FIFO page replacement

PO-CO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	4	4	1	1	1	1	1	1	1	5
CO2	2	4	4	4	5	1	1	1	1	1	1	5
CO3	2	4	2	2	5	1	1	1	1	1	1	5
CO4	2	2	2	2	1	1	1	1	1	1	1	5

CE-201 ARTIFICIAL INTELLIGENCE

COURSE OUTCOMES:

After completion of the course, a student will be able to

CO 1 Study the concepts of AI and related searching algorithms.

CO 2 Develop the knowledge skills and it's representational structure in AI

CO 3 Study the concepts of natural language processing in AI.

CO 4 Study the concepts of supervised/unsupervised machine learning and game technique.

CO 5 Study how design the programming skill in PROLOG, and concepts of pattern recognition approaches.

UNIT I

Introduction to AI: Foundations of AI, History of AI, State of Art Intelligent agents: Agents and Environments, The concept of Rationality, Structure of Intelligent Agent Problem Solving by Searching: Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions

UNIT II

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions, Searching with Partial Observations. Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Local Search for CSPs, The Structure of Problems.

UNIT III

Logical Agents: Knowledge-Based Agents, The Wumpus World, Logic and Propositional Logic First-Order Logic: Syntax and Semantics of First-Order Logic, First-Order Logic, Knowledge Engineering in First-Order Logic InferenceinFirst-OrderLogic:Propositionalvs.First-OrderInference,UnificationandLifting,ForwardChaining and Backward Chaining, Resolution

UNIT IV

Classical Planning: Definition of Classical Planning, Planning Graphs, Other Classical Planning Approaches Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Bayes' Rule and its use

UNIT V

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction

Text Book

1. StuartRussel&PeterNorvig:ArtificialIntelligenceAModernApproach.(PersonEducationAsia.)
2. Artificial Intelligence –Mishra,PHI
3. D.W. Patterson, "Introduction to A.I and Expert Systems",PHI,
4. Rich & Knight, "Artificial Intelligence", Tata McGraw Hill,.
5. W.F. Clocksin and Mellish, "Programming in PROLOG", Narosa Publishing House, 3/e

CO-PO MAPPING

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	4	5	5	4	4	2	2	1	1	1	1	
CO 2	2	4	5	2	4		2	1	1	1	1	1
CO 3	2	2		2	2		5	1	1	1	1	1
CO 4	4	2	4	5	2		2	1	1	1	1	1
CO 5	2	4	5	5	4		2	1	1	1	1	1

CE-201 DATA SCIENCE

Course Outcomes

CO 1: To explicate data analysis techniques and quantitative modelling for the solution of real-world Business problems.

CO 2:To report findings of analysis and effectively present using data visualization techniques.

CO 3:To demonstrate knowledge of statistical data analysis techniques utilized in business decision making.

CO 4: To provide insights about the roles of a Data Scientist, such as a developer, an analyst, a statistical Expert etc.

CO 5: To understand the techniques and tools for transformation of data

UNIT I

Data Scientist's Tool Box: Turning data into actionable knowledge Introduction to the tools that will be used in building data analysis software. Version control, markdown, git, GitHub, R, and RStudio

UNIT II

Overview of R, R data types and objects, reading and writing data.
Control structures, functions, scoping rules, dates and times, Loop functions. Debugging tools, Simulation, code profiling.

UNIT III

Getting and Cleaning Data.
Obtaining data from the web, from APIs, from databases and from colleagues in various formats. Basics of data cleaning and making data "tidy".

UNIT IV

Exploratory Data Analysis, Essential exploratory techniques for summarizing data, applied for formal modelling commences
Eliminating or sharpening potential hypotheses about the world that can be addressed by the data. Common multivariate statistical techniques used to visualize high-dimensional data.

UNIT V

Make beautiful visualizations using the ggplot2 library
Create commonly used data visualizations for each data type including histograms, scatter plots, and box plots, improve your data visualizations using facets.
Create reference variables using appropriate scope, Use the popular diamonds dataset to put your R skills to work.

Text Books

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontline" by Schroff/O'Reilly,2013.
2. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking by O'Reilly,2013.

Reference Books

1. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight"

by John Wiley & Sons,2013.

2. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley,2013.

PO-CO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	4	4	1	1	1	1	1	1	1	2
CO2	2	4	4	4	1	1	1	1	1	1	1	2
CO3	2	4	2	2	1	1	1	1	1	1	1	2
CO4	2	4	2	2	1	1	1	1	1	1	1	2
CO 5	2	4	2	2	1	1	1	1	1	1	1	2

OE-01 E-COMMERCE

Course Outcomes

CO:1To explicate data analysis techniques and quantitative modelling for the solution of real-world

Business problems.

CO 2: Toreportfindingsofanalysisandeffectivelypresentthemusingdatavisualizationtechniques.

CO 3: To demonstrate knowledge of statistical data analysis techniques utilized in business decision

making.

CO 4: Applying the e-commerce concept in business world

UNIT I

Introduction: -Overview of Electronic Commerce - Definition of Electronic Commerce - E Business– Categories of E-Commerce Application Benefits: - Potential benefits of E Commerce - Advantages and Disadvantages of E-commerce- Impact of E Commerce on Business –Global trading Environment of E-commerce– The global information distribution networks Legal and Ethical Issues: - The regulatory environment for E Commerce-Issues related to E-commerce- Legal Issues

UNIT II

Business Model of E-commerce, Internet Trading Relationships- Consumer to Business (C2B) Business to Consumer(B2C)

Business to Business (B2B), Consumer to Consumer (C2C)-Business to Government (B2G) Difference between B2C and B2B E-Commerce, Advantages and

Disadvantages.

UNIT III

E-Commerce and EDI, introduction to Electronic Data Interchange (EDI)- Benefits Features of EDI – EDI Model- EDI Standards - Data Transfer and Standards – Cost of EDI Electronic Funds Transfer–EFT-Combining EDI and EFT- Roles of Banking EDI

UNIT IV

Security Overview: Cryptography and Authentication Introduction - Messaging Security Issues Confidentiality - Integrity - Authentication. Encryption Techniques, Digital Signatures
Good Encryption Practices – Key Management - key management tasks – Additional Authentication Methods. Firewalls -Definition - component - Functionality - securing the firewall - factors considered in securing the firewall -Limitations.

Text Books

1. Electronic Commerce - Security, Risk Management and Control, Greenstein and Feinman.
2. Electronic Commerce: From Vision to Fulfillment, Elias M Award(PHI)

Reference Books

1. E-Commerce and Mobile Commerce Technology- U.S. Pandey, Saurabh Shukla, S.Chand
2. Electronic Commerce - A Managerial Perspective, Ed-aim Turban, Jae Lcc, David King Michael Chung, Addison Wesley, NewDelhi.

PO-CO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	4	4	1	1	1	1	1	1	1	2
CO2	2	4	4	4	5	1	1	1	1	1	1	2
CO3	2	4	2	5	5	1	1	1	1	1	1	2
CO4	2	2	2	5	1	1	1	1	1	1	1	2

SEM-III HC-301 COMPUTER NETWORKS

Course Outcomes

CO1: Identify data communications system components, network topologies, and protocols.

CO2: Analyze different features of analog and digital transmission.
CO3: Analyze the working principles and protocols of data link layer.
CO4: Identify and differentiate working principles and protocols of network and transport layer.
CO5: Identify and implement different types of application in application layer.

UNIT I

Overview of Data Communications: Network Topologies, Reference Models: OSI Model. Physical Layer: Analog and Digital Signals, Data Rate Limits, Transmission Impairment. Digital Transmission: Line Coding, Sampling, Transmission Modes.

UNIT II

Analog Transmission: Modulation of Digital Data, Modulation of Analog signals.

Multiplexing: Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM), Time Division Multiplexing(TDM). Switching Techniques: Circuit Switching and Packet Switching.

UNIT III

Errors: Types of Errors, Error Detection, Error Correction. Data Link Control and Protocols: Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ Wireless LANs: IEEE 802.11 and its architecture

UNIT IV

Host to Host Delivery: IP Addressing and Routing: Unicast, Multicast, Broadcast, and Anycast

Network Layer Protocols: Address Resolution Protocol (ARP), IPV4, Internet Control Message Protocol (ICMP), IPV6. Transport Layer: User Datagram Protocol (UDP), Transmission Control Protocol (TCP)

UNIT V

Client Server Model: Domain Name System (DNS): Electronic Mail (SMTP).

File Transfer: File Transfer Protocol (FTP), Post Office Protocol (POP), HyperText Transfer Protocol (HTTP) and World Wide Web(WWW) Network Security: Authentication, Digital Signatures and Certificates, Firewalls.

Text Books

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Edition.
2. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall,5th Edition.

Reference Books

1. Data and Computer Communications: William Stallings, Prentice Hall,9th Edition
2. Data Communication and Computer Networks: Ajit Pal, PHI Learning Pvt.Ltd

PO-CO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	4	2	2	4	4	1	1	1	1	1	1	2
CO2	4	4	4	4	5	1	1	1	1	1	1	5
CO3	2	4	2	2	5	1	1	1	1	1	1	5
CO4	2	2	2	2	2	1	1	1	1	1	1	5
CO5	2	4	4	4	4	1	1	1	1	1	1	1

HC-302 SOFTWARE ENGINEERING

Course Outcomes:

CO 1:To provide the idea of decomposing the given problem into Analysis, Design, Implementation,
Testing and Maintenance phases**.**

CO 2:To provide an idea of using various process models in the software industry according to given circumstances.

CO 3:Togaintheknowledgeofhowtogatherandspecifyrequirementsofthsoftwareprojects.

CO 4:To differentiate different testing methodologies and their utilities.

CO 5: To understand and apply the basic project management practices in real life projects

CO 6: Toenhancetheabilitytoworkinateamaswellasindependentlyonsoftwareprojects

UNIT I

Computer-Based system Engineering: Emergent System Properties, Systems and their Environment, System Modeling, System Engineering Process, System Procurement. Software Process: Software Process Models, Process Iteration, Software Specification, Design and Implementation. Software Validation and Evaluation, Automated Process Support.

UNIT II

Software Requirements: Functional and Non-Functional Requirements, Use Requirements. System Requirements, Software Requirements Document. Requirements Engineering Processes: Feasibility Studies, Requirements Elicitation and Analysis, Requirements Validation, Requirements Management. System Models: Context Models, Behavioral Models, Data models, Object models.

UNIT III

ArchitecturalDesign:SystemStructuring,ControlModels,ModularDecomposition,Domain-pecificArchitectures. Distributed System Architectures:Multiprocessor

Architectures, Client-Server Architectures, Distributed Architectures, CORBA. Patterns. Dependability: Critical Systems, Availability and Reliability, Safety, Security, Critical Systems

UNIT IV

Specifications: Software Reliability Specification, Safety Specification, Security Specification. Critical Systems Development: Fault Minimization, Fault tolerance, Fault Tolerance Architectures, Safe System Design. Object Oriented software design, Development process.

UNIT V

UML: Unified Modeling Language, Use case diagram, Class diagrams, essential Interaction diagram, Object diagram, Packages and collaboration. State diagrams, Activity diagrams, Physical diagrams.

Text Books

1. Software Engineering – Sommerville, Addition-Wesley
2. Software Engineering- Pressman, R.S,MGH

Reference Books

1. Fundamental of Software Engineering—Rajib Mall,PHI
2. Software Engineering- Agarwal, K.K & Singh, New Age International.

PO-CO MAPPING TABLE

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	4	4	1	1	4	4	1	1	4	5	4	4
CO 2	4	5	4	4	5	1	1	1	1	4	1	1
CO 3	4	5	5	5	5	1	1	1	4	4	1	1
CO 4	5	5	4	5	5	1	1	1	4	4	1	5
CO 5	1	4	4	1	4	1	1	1	5	4	4	1

HC-303 **Computer Network & Software Engineering Lab**

a) Computer Networks Practical
b) Software Engineering Practical

Course Outcome

CO 1: Acquire knowledge of Networking Parameters
CO 2: Able to do establish Client/Server Communication using Socket
CO 3:Learn how to use File Transfer protocol
CO 4: Learn to use Software Engineering Tools to develop various automated systems.
CO5: Using UML tools to analyse project work

a) Computer Networks

List of Experiment (Using C/C++/Java)

1. Listing Network Interface Properties
2. Getting the ownIP.
3. Implementing Ping Program.
4. Implementation of port scanner
5. Implements TCP Sockets for displaying date & time from server
6. Implementing File Transfer.

b) Software Engineering (Using sample case study on Bank ATM System)

1. Introduction To software engineering
    a. Defining Problem definition
    b. Writing SRS
        i. Introduction
        ii. Overall Description
        iii. Specification Requirement
        iv. Front End ,Back End Specification
        v. Data Structure
        vi. DFD
        vii. Testing
        viii. Sample screen
2. OO Analysis & Design Using UML (Sample diagrams)
    a. UseCase
    b. Class diagram

c. State chart diagram
d. Activity Diagram
e. Collaboration Diagram
f. Package Diagram

PO-CO MAPPING TABLE

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	4	1	1	1	1	1	1	1	1	1	2
CO 2:	2	4	4	4	1	1	1	1	1	1	1	2
CO 3	2	2	2	2	2	1	1	1	1	1	1	2
CO 4	2	2	2	2	2	1	1	1	1	1	1	2
CO 5	2	4	2	4	2	1	1	1	1	1	1	2

SEM-III CEC-301 COMPILER DESIGN

COURSE OUTCOMES:

After completion of the course, a student will be able to

CO 1 Understand the internal steps of compiler.
CO 2 Understand the fundamental concepts of formal language.
CO 3 Implementation of top down and bottom up parsers.
CO 4 Understand the usage of lex and yacc tools.
CO 5 Understand SDD, SDT, intermediate code generation and machine code generation.

UNIT I:

Introduction to Compiler Design: Introduction to Compiler Design, Phases of Compiler Design, Compiler Construction Tools
Lexical Analysis: DFA, NFA, Regular Expression, Equivalent to NFAs, Minimizing the States of DFA CFG: Basics of CFG, Normal Forms, Implementation of Lexical Analyser.

UNIT II

Syntax analysis: Top down parsing concepts-Recursive Descent Parsing, FIRST and FOLLOW, LL(1) Grammars Left Recursion Elimination, Top-Down Recursive-Descent parsing
Bottom-Up Parsing: Reduction, Finding Handles, Shift-Reduce Parsing, Conflicts during Shift-Reduce Parsing
LR Parsers: Items and the LR(0) Automaton, The LR-Parsing Algorithms, SLR, CLR, LALR, Ambiguous Grammars

UNIT III

Syntax-Directed Translation: Syntax Directed Definitions, Evaluating Orders for SDD,
Applications of Syntax –Directed Translation Scheme
Intermediate code generation: Variations of Syntax, Three-Address Code- Addresses and Instructions, Quadraples, Triples
Translation of Expression: Operation within Expressions, Incremental Translation, Addressing Array Elements, Translation of Array References

UNIT IV

Type Checking: Rules for Type Checking, Type Conversions, Overloading of Functions and Operators Control Flow: Boolean Expressions, Short-Circuit Code, Flow of Control Statements, Control Flow Translation of Boolean Expressions, Backpatching
Run Time Environment: Storage organization, Stack Allocation of Space, Heap Management

UNIT V

Code Generation: Issues in the Design of Code Generation, Addresses in the Target Code, Basic Blocks and Flow Graphs
Code optimization: Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.
Machine Independent Optimization: The Principle of Source of Optimization, Introduction to Dats Flow Analysis, Introduction to Inter procedural Analysis

Text Books

1. AlfredAho,RaviSethi,JeffyD.Ullman,"Compilers-Principles,TechniquesandTools",Pearson
2. ChattopadhyaySanthanu, "Compiler Design",PHI.
3. HolubAllen, "Compilers in C",PHI

CO-PO-MAPPING

CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	4	1	1	4	1	2	1	1	1	1	1	4
CO 2	4	1	4	1	4	1	1	1	1	1	1	4
CO 3	4	4	1	4	1	4	1	1	1	1	1	4
CO 4	4	1	4	1	4	1	1	1	1	1	1	4
CO 5	2	1	1	4	1	5	1	1	1	1	1	4

SEM-III CE-301 GRAPH THEORY

Course Outcomes

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CO1. Explain the concept of formal graph-theoretic definitions, notations, apply Handshaking theorem and Havel-Hakimi theorem, learn about graph isomorphism.

CO2. Find shortest paths in graphs, understand connectedness in graphs, and define Eulerian graphs, Hamiltonian graphs.

CO3. Learn about trees and tree traversal algorithms, apply algorithms to find minimum spanning trees.

CO4. Understand graph planarity, find geometric and combinatorial dual, learn about matching and coverings in graphs,

CO5. Define Independent set, and clique in a graph and understand graph colouring in detail

UNIT I

Graph Terminologies, Simple Graph, Multigraph, Special Graphs, Complement Graph, Regular Graph, Bipartite Graphs, Subgraphs: Proper Subgraph, Spanning Subgraph, Induced Subgraph, Vertx-degrees, Handshaking Theorem, Graphic Sequences, Havel-Hakimi Theorem. Graph Representation: Adjacency Matrix, Incidence Matrix, Adjacency List, Graph Isomorphism.

UNIT II

Connected Graphs, Disconnected Graphs and Components, Cut-vertices, Cut-edge, Blocks, Cut-set. Weighted Graphs, Shortest Paths, Dijkstra's Algorithm. Eulerian Graphs, Hamiltonian Graphs.

UNIT III

Trees, Properties of Trees, Pendant Vertices in a Tree, Distance and Centers in a tree, Rooted and Binary Trees. Counting Tree, Spanning Tree, Spanning Tree, Minimum Spanning Tree, Prim's Algorithm, Kruskal's Algorithm. Tree Traversal: Pre-order, Post-order and In-order Traversal.

UNIT IV

Combinatorial Vs Geometric Graphs, Planar Graphs, Kuratwoski Graphs, Detection of Planarity. Geometric and Combinatorial Dual, Thickness and Crossings. Matchings, Matchings and Coverings in Bipartite Graphs, Perfect Matching.

UNIT V

Independent Set, Clique. Graph Coloring, Chromatic Number, Chromatic Partitioning, Greedy

Coloring Algorithm, Coloring of Chordal Graphs, Brooks Theorem. The Four Colour Conjecture and Five-Colour Theorem.

Text Books

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.
2. D.B. West, Introduction to Graph Theory.
3. J. A. Bondy and U. S. R. Murty: Graph Theory.
4. Jon Kleinberg and Eva Tardos, Algorithm Design.

Reference Books

1. T.H. Corman, C.E.Leiserson, R.L.Rivest and C. Stein, Introduction to Algorithms.

PO-CO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	4	4	2	4	2	1	1	1	1	1	1	2
CO2	5	4	4	5	2	1	1	1	1	1	1	2
CO3	5	4	4	5	2	1	1	1	1	1	1	2
CO4	5	4	4	5	2	1	1	1	1	1	1	2
CO5	5	4	4	5	2	1	1	1	1	1	1	2

SEM –III CEC-302 CLOUD COMPUTING

Course Outcomes:

CO1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges of Cloud.
CO2: Develop applications using various models and services in cloud computing.
CO3: Understand virtualization and outline their role in enabling the cloud computing system model. and implement different load balancing algorithms in cloud.
CO4: ExplainService Management in Cloud Computing.
CO5: Understand security mechanisms implemented at different levels.

UNIT I:

Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing.
Introduction to Cloud Computing**:** Introduction, History of Cloud Computing, Characteristics of cloud computing, Benefits and limitations of Cloud Computing.
Cloud Service Providers (CSPs), Cloud Data Centres, Components of data Centres, Cloud Computing applications.

UNIT II:

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

UNIT III:

Virtualization: Introduction, Characteristics of Virtualized Environments.
Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization.
Load balancing in Cloud Computing: Importance of load balancing, Types of load balancing, Load balancing algorithms.

UNIT IV:

Case Studies: Case Study of Service Model using Google App Engine, Microsoft Azure, Amazon EC2.
Service Management in Cloud Computing: Service Level Agreements (SLAs), Billing & Accounting. Comparing Scaling Hardware: Traditional vs. Cloud, Types of Scaling, Economics of Scaling.

UNITV:

Cloud Security: Infrastructure Security: Network level security, Host level security, Application level security.
Data security and Storage: Aspects of data security, Provider data and its security, Data security issues. Jurisdictional issues raised by data location, Authentication in Cloud, Methods of Authentication.

Text Books

1. Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, "*Cloud Computing Principles & Paradigms*", Wiley,2013.
2. Tim Mather, SubraKumaraswamy, ShahedLatif, "*Cloud Security and Privacy",* O' Reilly, First Edition,2011.

Reference Books

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "*Mastering Cloud Computing*", McGraw Hill Education,2018.
2. Barrie Sosinsky, "*Cloud Computing Bible*", Wiley,2011.
3. Nick Antonopoulos, Lee Gillam, "*Cloud Computing: Principles, Systems and Applications*", Springer,2010.

PO-CO MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	5	4	4	2	4	1	1	1	2	1	1	4
CO2	4	5	4	4	2	1	1	1	4	1	4	2
CO3	2	1	1	1	1	1		1	1	1	4	4
CO4	4	1	1	1	1	1	1	1	1	1	1	2
CO5	4	1	1	1	1	1	1	1	4	1	4	4

SEM –III CEC-302 SOFT COMPUTING

COURSE OUTCOMES

CO1: Describe human intelligence and AI and explain how intelligent system works.
CO2: Apply basics of Fuzzy logic and use of heuristics based on human experience
CO3: Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
CO4: Identify the issues in multi-objective optimization problemsandapply differentmulti-objective optimization techniques.
CO5: Apply different ANN techniques to real world problems

UNIT I:

Introduction: Concept of computing systems. Hard computing, Soft computing, Hybrid computing. Optimization and Some Traditional methods: Introduction to Optimization, Traditional methods of optimization. Some Applications of Soft Computing.

UNIT II:

Fuzzy Logic: Introduction to Fuzzy logic. Fuzzy sets and membership functions. Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences. Defuzzification techniques. Fuzzy logic controller design. Some applications of Fuzzy logic.

UNIT III:

Genetic Algorithms (GA):Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques. Basic GA framework and different GAarchitectures. GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GA. Some specialized GAs: Real-coded GA, Micro-GA

UNIT IV:

Multi-objective Optimization problem solving: Concept of multi-objective optimization problems(MOOPs)andissuesofsolvingthem.Multi-ObjectiveEvolutionaryAlgorithm(MOEA). Non-Pareto approaches to solve MOOPs. Pareto-based approaches to solve MOOPs. ome applications with MOEAs.

UNIT V:

Artificial Neural Networks: Biological neurons and it's working. Simulation of biological neurons to problem solving. ANN architectures: Different ANN Architectures.
ANN Training: Training techniques for ANNs. Applications of ANNs to solve some real-life problems.

Text Books

1. R. Rajasekaran and G. A. VijayalakshmiPai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India, New Delhi, 2003
2. D. K. Pratihar, Soft Computing, Narosa,2008
3. L.Fausett,FundamentalsofNeuralNetworks,PrenticeHall,UpperSaddleRiver,N.J,1994.
4. F.Martin,Mcneill,andEllenThro,FuzzyLogic:APracticalapproach,APProfessional,2000.

Reference Books

- J.-S.R.Jang,C.-T.Sun,andE.Mizutani,Neuro-FuzzyandsoftComputing,PHILearning,2009.
- D. E. Goldberg, Genetic Algorithms in Search, Optimisation, and Machine Learning, Addison- Wesley, Reading, MA,1989

PO-CO MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	4	2	2	1	1	1	1	1	1	1	1	5
CO2	2	5	4	4	1	1	1	1	1	1	1	4
CO3	2	5	4	4	1	1	1	1	1	1	1	4
CO4	2	5	4	4	1	1	1	1	1	1	1	5
CO5	2	5	4	4	1	1	1	1	1	1	1	4

SEM-IV HC-401 APPLIED CRYPTOGRAPHY

Course Outcome

CO 1 Illustrate the concepts of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security

CO 2 Gain familiarity with prevalent network and distributed system attacks, defences against them, and forensics to investigate the aftermath.

CO 3 Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today

CO 4 Summarize different Authentication Techniques such as hashing, various digital signature techniques, etc

CO 5 Determine appropriate mechanisms for protecting information systems ranging from operating systems to database management systems and to applications.

UNIT I

Introduction, The need of Security, Security approaches, Principles of Security, Types of Security Attacks, Security Services, Security Mechanisms, A model for Network Security.

Cryptography: Concepts and Techniques: Introduction, Plain text and Cipher text, Substitution Techniques, Transposition Techniques, Encryption and Decryption.

Symmetric and Asymmetric Cryptography, Steganography, Key Range and Key Size, Possible types of Attacks.

UNIT II

Symmetric Key Ciphers: Block Cipher Principles and Algorithms. DES, AES, and Blowfish. Differential and Linear Cryptanalysis, Block Cipher Modes of Operations, Stream Ciphers, RC4, Location and Placement of encryption function, Key Distribution.

Asymmetric Key Ciphers: Principles of Public Key Cryptosystems, Algorithms, RSA, Diffie-Hellman, ECC, Key Distribution.

UNIT III

Message Authentication Algorithms and Hash Function: Authentication Requirements, Functions, Message Authentication Codes, Hash Functions.

Secure Hash Algorithms, Whirlpool, HMAC, CMAC, Digital Signatures.

Authentication Applications: Kerberos, X.509 Authentication Services, Public-Key Infrastructure, Biometric Authentication.

UNIT IV

Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Intruders.

Viruses and Firewalls: Intruders, Intrusion Detection, Password Management, Virus and related threats, Countermeasures, Firewall Design Principles, Types of Firewalls.
Case Studies on Cryptography and Security: Secure Inter Branch Transactions, Cross Site Vulnerability, Virtual Elections.

UNIT V

Introduction to Information Hiding, Steganography and Watermarking.
Fragile watermarking, Reversible watermarking.
Importance of digital watermarking, Applications, Properties, Evaluating watermarking systems.

Text Books

1. Cryptography and Network Security – AtulKahate –TMH.
2. Data Communications and Networking – BehourzAForouzan

Reference Book

1. CyberSecurityOperationsHandbook–J.W.RittiaghouseandWilliamM.Hancok,Elsevier.
2. CryptographyandNetworkSecurityPrinciplesandPractice–W.Sta1lings,PearsonEducationAsia.

CO-PO MAPPING TABLE

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3	PSO 4
CO 1	5	1	2	1	2	1	1	1	1	1	1	1	1	4	1	4
CO 2	5	2	4	1	1	2	1	2	1	1	1	1	4	5	4	1
CO 3	4	4	2	2	4	2	1	1	1	1	1	1	4	5	4	5
CO 4	4	4	4	2	2	1	1	2	1	1	1	1	1	4	4	5
CO 5	4	2	5	1	1	4	1	4	1	1	1	1	5	1	5	1

(a)

(b)

HC-402 Java & Applied Cryptography Practical [30+70=100]

a) Java Practical

b) Applied Cryptography Practical

Learning /Course Outcomes

At the end of the course, the student should be able to:

CO 1:Implement the cipher techniques

CO 2: Develop the various security algorithms

CO 3: Use different open source tools for network security and analysis

CO 4: To Understand OOP concepts and basics of Java programming

List of Experiments

a) Java Programming

1. WAP to display Fibonacci series upto n terms terms
2. WAP to demonstrate String class and its methods.
3. Program to demonstrate use of class and objects.
4. Write a java program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
5. Program to demonstrate use of inheritance
6. Programtodemonstrateuseofexceptionhandling(DividebyZero&ArrayoutofBound)
7.

b) Applied Cryptography

Implement following Cryptography algorithm using JAVA

1. Caesar Cipher
2. Play fair Cipher
3. Vigenere Cipher.
4. Diffie-Hellman Key exchange
5. DES
6. AES

CO-PO Mapping table

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	4	4	1	1	1	1	1	1	1	5
CO2	2	4	4	4	5	1	1	1	1	1	1	5
CO3	2	4	2	2	5	1	1	1	1	1	1	5
CO4	2	2	2	2	1	1	1	1	1	1	1	5

SEM-IV CE-401 DATA MINING

Course Outcome

CO 1: Design a data mart or data warehouse for any organization
CO 2: Develop skills to write queries using DMQL
CO 3:Extract knowledge using data mining techniques
CO 4: Adapt to new data mining tools.
CO 5: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data

UNIT I:

Introduction to data mining: Motivation, Importance, Definition of Data Mining, Kind of Data, Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System with A Database or Data Warehouse System, Major Issues in Data Mining

UNIT II:

Types of Data Sets and Attribute Values, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity. PREPROCESSING: Data Quality, Major Tasks in Data Preprocessing, Data Reduction, Data Transformation and Data Discretization, Data Cleaning and Data Integration. Data warehousing and on-line analytical processing: Data Warehouse basic concepts, Data Warehouse Modeling

UNIT III:

Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction. Data Cube Technology: Efficient Methods for Data Cube Computation, Exploration and Discovery in Multidimensional Databases.

UNIT IV:

Mining frequent patterns, associations and correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Are All the Pattern Interesting, Pattern Evaluation Methods, Applications of frequent pattern and associations. Frequent pattern and association mining: A Road Map, Mining Various Kinds of Association Rules, Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns.

UNIT V:

Classification: Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Ensemble Methods, Handling Different Kinds of Cases in Classification, Bayesian Belief Networks,
Classification by Neural Networks, Support Vector Machines, Pattern-Based Classification, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

Text Books

1. Jiawei Han, Micheline Kamber, Jian Pei (2012), Data Mining: Concepts and Techniques, 3rd. edition, Elsevier, United States of America.

Reference Books:

1. Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2nd edition, Pearson Education, New Delhi,India.
2. Amitesh Sinha (2007), Data Warehousing, Thomson Learning,India.

PO-CO MAPPING TABLE

SEM-IV CE-401 INTERNET OF THINGS

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	4	4	1	1	1	1	1	1	1	2
CO2	2	4	5	5	1	1	1	1	1	1	1	2
CO3	2	4	2	2	1	1	1	1	1	1	1	2
CO4	2	4	4	4	1	1	1	1	1	1	1	2
CO 5	2	4	4	4	1	1	1	1	1	1	1	2

Course Outcome

- CO1: Identify the Components that forms part of IoT Architecture.
- CO 2: Determine the most appropriate IoT Devices and Sensors based on Case Studies.
- CO 3: Setup the connections between the Devices and Sensors.
- CO 4: Evaluate the appropriate protocol for communication between IoT.
- CO 5: Analyse the communication protocols for IoT.

UNIT I

Fundamentals of IoT: Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (Io TWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II

Io T Protocols: Io T Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT.

UNIT III

Design and Development: Design Methodology, Embedded computing logic icrocontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms, Raspberry pi, Arduino Board details

UNIT IV

Data Analytics and Supporting Services: Introduction, Structured Versus Unstructured Data Data in Motion vs Data at Rest, Io T Data Analytics Challenges, Data Acquiring
Organizing in Io T/M2M,Supporting Services: Computing Using a Cloud Platform for IoT/M2M

UNIT V

Applications/Services, Everything as a service and Cloud Service Models. Case Studies/Industrial Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances. Other IoT electronic equipment, Industry 4.0 concepts.

Text Books

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes,GonzaloSalgueiro,PatrickGrossetete,RobBartonandJeromeHenry,CiscoPress,2017.
2. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education

Reference Books

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (forUnit2).
2. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino
3. Cookbook and O'Reilly Media,2011

CO1	2	2	4	4	1	1	1	1	1	1	1	2
CO2	2	2	4	4	1	1	1	1	1	1	1	2
CO3	2	4	5	5	1	1	1	1	1	1	1	2
CO4	2	4	2	2	1	1	1	1	1	1	1	2
CO 5	2	4	4	4	1	1	1	1	1	1	1	2

PO-CO MAPPING TABLE