Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

S.Y. B. Sc. (Computer Science)

Choice Based Credit System (CBCS) Syllabus
Under National Education Policy (NEP)

To be implemented from Academic Year 2024-2025

Level:- 5.0 (Second Year) Sem:III

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsCmpU3101	Data Structures	2		2		20	30	50
	24CsCmpU3102	Database Management System	2		2		20	30	50
	24CsCmpU3103	Lab on 24CsCmpU3101 and 24CsCmpU3102		2		4	20	30	50
VSC P(2)	24CsCmpU3501	Lab on Scripting Languages		2		4	20	30	50
IKS (T/P)(2)	24CsCmpU3901	Vedic Maths and Computer Fundamentals	2		2		20	30	50
FP P(2)	24CsCmpU3002	Field Project I		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24CsMatU3301 / 24CsEleU3301	Intel 8051 and Raspberry Pi/ Advanced Discrete Mathematics	2		2		20	30	50
	24CsMatU3302/ 24CsEleU3302	Lab course on 24CsMatU3301 / Lab course on 24CsEleU3301		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU3401	Cyber Security	2		2		20	30	50
AEC T(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CC T(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			14	8	14	16			550

Level:- 5.0 (Second Year) Sem:IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsCmpU4101	Advanced Data Structures	2		2		20	30	50
	24CsCmpU4102	Advanced Database Management System	2		2		20	30	50
	24CsCmpU4103	Lab on 24CsCmpU4101 and 24CsCmpU4102		2		4	20	30	50
VSC P(2)	24CsCmpU4501	Lab on OOP using C++		2		4	20	30	50
CEP P(2)	24CsCmpU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24CsMatU4301 / 24CsEleU4301	Analog and Advanced Digital Communication/ Groups and Coding Theory	2		2		20	30	50
	24CsMatU4302 / 24CsEleU4302	Lab course on 24CsMatU4302 / Lab course on 24CsEleU4302		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU4401	Web Designing	2		2		20	30	50
SEC T(2)	24CsStaU4601	Data Mining	2		2		20	30	50
AEC T(2)	24CpCopU4701 / 24CpCopU4702	MIL-II (Hindi) / MIL-II (Marathi)	2		2		20	30	50
CC T(2)	24CpCopU4001	Health and Wellness	2		2		20	30	50
Total			14	8	14	16			550

Detailed Syllabus

SEM- III

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune - 5

Second Year of B.Sc. (Computer Science)

(2024 NEP Course)

Course Code: 24CsCmpU3101

Course Title: Data Structures

Teaching Scheme: 2 Hours /Week **Credit: 2**

Examination Scheme: CIA: 20 **End-Sem: 30**

Prerequisites: Student must be aware of C Programming.

Objectives:

- Study of various data structures at logical, implementation and application level.

Course Outcome:

- Understand Data Structures and their effective and efficient use in solving complex problems.
- Students will able to improve their problem-solving ability by using data structures.

Course Contents:

Unit 1	Introduction to Data Structures	4 lectures
	1.1 Data Structure Concept 1.2 Abstract Data Type 1.3 Data Structures in C - Arrays and their implementation	

	- Structure - Union	
Unit 2	**Sorting Algorithms**	**6 lectures**
	2.1 Sorting Algorithms and their efficiency comparison using Big Oh - Bubble Sort - Insertion Sort - Quick Sort - Merge Sort - Counting Sort	
Unit 3	**Searching Algorithms**	**6 lectures**
	3.1 Searching Algorithms and their efficiency comparison using Big Oh 3.2 Sequential /Linear Search 3.3 Binary Search	
Unit 4	**The Stack**	**8 lectures**
	4.1 Definition and Operations 4.2 Implementation using Array 4.3 Applications – Infix to postfix, postfix evaluation, infix to prefix, prefix evaluation, Recursion	
Unit 5	**The Queue**	**8 lectures**
	5.1 Definition and Operations 5.2 Implementation using Array (Linear and Circular) 5.3 **Priority Queue:** Definition and Operations 5.4 Array Implementation	

Reference Books:

1. Data Structures Using C and C++ By Yedidyah Langsam, Moshe J. Augemstein, Aaron M. Tanenbaum
2. Data Structures A Pseudocode Approach with C By Richard F. Gilberg and Behrouz A. Forouzan

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Second Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsCmpU3102
Course Name: Database Management System

Teaching Scheme: TH: 2 Hours/ Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem :30 Marks**

Prerequisites:

- Basic Computer Awareness
- Basic Knowledge of file system, storing data in file system

Course Objectives:

- To understand the fundamental concepts of database.
- To understand user requirements and frame it in data model.
- To understand creations, manipulation and querying of data in databases

Course Outcomes:

On completion of the course, student will be able to–

- Apply linguistic theory like Database Design.
- Design E-R Model for given requirements and convert the same into database tables.
- Solve real world problems using appropriate set, function, and relational models.

Course Contents:

Unit 1	Introduction of DBMS	2 lectures
	1.1 Introduction to Files, Databases 1.2 File system Vs DBMS 1.3 Describing & Storing data - Data models 1.3.1 Relational Model 1.3.2 Hierarchical Model 1.3.3 Network Model 1.4 Levels of Abstraction in DBMS 1.5 Data Independence	

	1.6 Structure of DBMS 1.7 Users of DBMS 1.8 Advantages & Disadvantages of DBMS	
Unit 2	**Relational Database Structure**	**2 lectures**
	2.1 Introduction to Attribute, Table, Tuple 2.1.1 Definition of Attribute 2.1.2 Definition of Table (Relation) 2.1.3 Definition of Tuple (Row) 2.2 Types of Attributes 2.2.1 Simple and Composite Attributes 2.2.2 Single-valued and Multi-valued Attributes 2.2.3 Stored and Derived Attributes 2.3 Key Attributes (Primary, Foreign, Candidate, and Super Key) 2.4 Types of Relationships 2.4.1 One-to-One (1:1) Relationship 2.4.2 One-to-Many (1:M) Relationship 2.4.3 Many-to-One (M:1) Relationship 2.4.4 Many-to-Many(M:M) Relationship	
Unit 3	**Conceptual Design (E-R Model)**	**8 lectures**
	3.1 Introduction to E-R model 3.2 Entity-Relationship Diagrams (ERD) 3.2.1 Symbols Used in E-R Diagram 3.2.2 Representing Entities, Attributes, and Relationships 3.2.3 Weak and Strong Entities 3.3 Generalization, Specialization, and Aggregation 3.4 Case Studies	
Unit 4	**Structured Query Language**	**12 lectures**
	4.1 Introduction to SQL 4.2 Data Types in SQL 4.3 DDL (Data Definition Language) Commands with Examples 4.3.1 CREATE Command 4.3.2 ALTER Command 4.3.3 DROP Command 4.4 DML (Data Manipulation Language) Commands with Examples 4.4.1 SELECT Command 4.4.2 INSERT Command 4.4.3 UPDATE Command 4.4.4 DELETE Command 4.5 DCL(Data Control Language) Commands . 4.6 Introduction to SQL queries 4.7 Integrity Constraints (primary key, foreign key, referential integrity, not null constraint, unique constraint & check constraint) 4.8 Aggregate functions 4.9 Intro. to SQL joins.	
Unit 5	Relational Database Design	**6lectures**
	5.1 Introduction to Relational Database Design	

	5.2 Introduction to Normalization 5.3 Normal Forms (Only Definitions) 5.3.1 First Normal Form (1NF) 5.3.2 Second Normal Form (2NF) 5.3.3 Third Normal Form (3NF) 5.4 Decomposition 5.4.1 Definition of Decomposition 5.4.2 Need for Decomposition in Database Design 5.4.3 Types of Decomposition (Lossy, lossless decomposition and Dependency-Preserving)	

References:

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S. Sudarshan Edition : 7th ISBN 9780078022159,Tata McGraw-Hill Education
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw HillScience/Engineering/Math; 3edition,ISBN:9780072465631
3. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe Edition: 7e Edition (2017) Publisher: Pearson ISBN: 978-9332582705
4. An Introduction to Database Systems by Bipin C. Desai Publisher: Galgotia Publications.
5. PracticalPostgreSQL(B/CD),JohnWorsley,JoshuaDrake, ISBN:9788173663925Shroff/O'reilly Systems

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S.Y. B.Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU3103
Course Name: Lab Course on 24CsCmpU3101 and 24CsCmpU3102

Teaching Scheme: PR: 4 Hours/ Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites

- Student must be aware of 'C' Programming.
- Basic knowledge of file system, storing data in file system
- Basic knowledge of Set operations.

Course Objectives:

- Study of various data structures at logical level.
- To implement various data structures at application level.
- To understand database design.
- To understand user requirements and frame it in data model.
- To understand creations, manipulation and querying of data in databases.

Course Contents:

Sr.No	**List of practical**
1	Write a C program to implement Bubble Sort.
2	Write a C program to implement Insertion Sort.
3	Write a C program to implement Quick Sort.
4	Write a C program to implement Merge Sort.
5	Write a C program to implement linear search.

6	Write a C program to implement binary search (Non-Recursive).
7	Write a C program to implement binary search (Recursive)
8	Write a C program to convert infix expression into postfix form.
9	Write a C program to implement evaluation of postfix.
10	Write a C program to implement Towers=of-hanoi.
11	Write a C program to implement static circular queue.
12	Write a C program to implement priority queue. (Ascending / Descending)
13	Assignment to create simple tables using DDL statements
14	Assignment: Case study To create more than one table, with referential integrity constraint, Primary Key constraint.
15	Assignments to create one or more tables with Check, Not null Constraints, alter table, drop table
16	Assignments to use simple forms of insert/update/delete statements
17	Assignment to query the tables using simple form of select statement.
18	Assignment to query table, using like, group by, order by clause in SQL
19	Assignment to query table, using aggregate functions.
20	Nested Queries

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Second Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsCmpU3501
Course Name: Lab on Scripting Languages (VSC P)

Teaching Scheme: 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem :30 Marks**

Prerequisite Courses:

- **Basic knowledge of Design.**

Course Objectives:

- The student should be able to design dynamic web pages using HTML scripting language.
- The student should be able to apply CSS properties suitably to make screen design attractive.

Course Outcomes:

On completion of the course, student will be able to–

- Design dynamic web pages using HTML 5 & CSS.
- Design various Forms, frames etc.

Course Contents: (Practical)

No	Topic
1	Creating simple HTML pages (use of different tags for changing fonts, foreground, and background colors etc.)
2	HTML programming (use of lists, tables, hyperlinks)
3	HTML programming using font , style , superscript, subscript tags.
4	HTML programming using hyperlinks, Use of header, footer, title, image, style, Marquee.
5	HTML programming Using list (ordered, unordered) tags.

6	HTML Programming using table, frames and iframes tags.
7	HTML Programming using Advanced feature of HTML (Using Inline CSS)
8	HTML Programming using Advanced feature of HTML (Using internal CSS and External CSS).
9	HTML Programming using Creation of forms, small case study to create HTML pages using all the above learning techniques.
10	HTML Programming using Creation of Forms layout designing by using div element with CSS property.

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(Autonomous College)

Second Year of B.Sc. (Computer Science) Minor: Electronics

Under Revised NEP2020 (NEP 2024)

SEMESTER III

Course Code: 24CsEleU3301 **Course Name: Intel 8051 and Raspberry PI**

Teaching Scheme: Th: 2hrs. / Week Credit : 02

Examination Scheme: CIA: 20 Marks End-Sem: 30 Marks

Prerequisites: Basic knowledge of Digital Electronics and C programming.

Course Objectives: This course will enable the students to:

1. Learn basic python programming.
2. Learn interfacing with Raspberry Pi.
3. Learn general input and Output connection.
4. Understand and apply Python syntax and semantics in program development.

Course Outcomes:

- Understand the architecture and operation of the 8051 and Raspberry Pi microcontrollers.
- Learn assembly and embedded C programming for these microcontrollers.
- Develop interfacing skills for peripherals such as LCD, Keypad, ADC, DAC, motors, and sensors.
- Implement embedded system applications using 8051

Course Contents

Chapter 1	**Introduction to Microcontrollers**	08 hrs
	Architecture & Features :- Intel 8051 architecture, Internal memory organization (RAM, ROM), Special function registers (SFRs), I/O ports and pin configuration, Timers and Counters ,Interrupts. **Assembly language programming**:- Addressing modes, Instruction set, assembler directives(ORG,DB, END),Delay generation using loops and timers, Serial communication.	
Chapter 2	C **Programming for 8051 microcontroller**	8hrs

	Peripheral Interfacing:- LED, Seven-Segment Display, LCD and Keypad, Serial Communication (UART),Timer-based delay generation.	
Chapter 3	**Raspberry Pi Fundamentals**	6Hrs
	Introduction: Raspberry Pi, Features of Raspberry Pi, History of Raspberry Pi, Architecture Overview, CPU Overview, CPU Pipeline Stages, Branch Prediction and Folding, Essential Input Output Devices, Setting Up Raspberry Pi, Raspbian OS, Linux commands for Raspberry Pi. GPIO Pins, Configuring GPIO Pins,	
Chapter 4	**Python programming for Raspberry Pi**	8 Hrs
	Python programming on Raspberry Pi platform, modules of Python Raspberry Pi. GPU Overview, Importing Libraries, Python and Hardware Access, **Interfacing**: LED, SSD, Switches, Alphanumeric LCD, ADC, Servo Motor, Stepper Motor with Raspberry Pi. Interfacing different sensors to Raspberry Pi – temperature, pressure, DHT11,PIR sensor, Ultrasonic sensor	

Text/ Reference Books:

1. "The 8051 Microcontroller and Embedded Systems" – Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin McKinlay, Pearson India, 2nd edition.
2. 8051 microcontroller hardware,software and application, B udayshankara,MS milikarjuna swami, McGraw Hill Education India. 1st edition.
3. Programming the Raspberry Pi Getting Started with Python, Simon Monk, McGraw Hill Education India, 3rd edition.
4. Python for Everybody, Dr. Charles R. Severance. https://www.py4e.com/
5. Learn RPI Programming with Python, Wolfram Donat.
6. Raspberry Pi User Guide by Eben Upton, Greath Halfacree John Wiley Publication
7. Raspberry Pi CookBook: Software & Hardware problems and Solutions by Simon Monk.
8. Python Crash Course: A Hands-On, Project-Based Introduction to Programming.
9. Raspberry Pi Robotic Projects - Third Edition Machine Learning For Absolute Beginner .

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(Autonomous College)

Second Year of B.Sc. (Computer Science) Minor: Electronics

Under Revised NEP2020 (NEP 2024)

SEMESTER III

Course Code: 24CsEleU3302
Course Name: Lab course on 24CsEleU3301 (Intel 8051 and Raspbery Pi)

Teaching Scheme: PR: 4 hrs / Week Credit : 02

Examination Scheme: CIA: 20 Marks End-Sem: 30 Marks

Prerequisites: Basic knowledge of Digital Electronics and C programming

Course Objectives: This course will enable the students to:

1. Learn basic python programming.
2. Learn interfacing with Raspberry Pi.
3. Learn general input and Output connection.
4. Understand and apply Python syntax and semantics in program development.

Course Outcomes: At the end of the course the student should be able to:

1. Understand the architecture and operation of the 8051 and Raspberry PI.
2. Learn assembly and embedded C programming for these microcontrollers.
3. Develop interfacing skills for peripherals such as LCD, Keypad, ADC, DAC, motors, and sensors.
4. Implement embedded system applications using 8051 and Raspberry PI.
5. Utilize Python & built-in data structures such as lists, tuples, sets, and dictionaries effectively.
6. Setting up the development environment.

Course Contents:(Any 12)

1. Basics of assembly program: basic arithmetic and logical instruction handling Code conversion, Equal length array addition, Array sorting.
2. Study of LED interfacing to 8051 and programme for LED blinking using 8051
3. Study of SSD interfacing and programming using 8051 as rolling display.
4. Study of Interfacing thumb wheel switch and SSD and programming of 8051

5. Study of LCD interfacing and its programming using 8051
6. Create a simple serial communication program to send characters between the 8051 and PC.
7. Study of waveform generations using DAC 8051.
8. Study for PWM Generation for speed control of DC motor using PIC
9. Study the Configuration of Raspberian OS.
10. Program to find square root of a number using Python programming.
11. Find prime number using Python programming.
12. Find smallest /largest from array of numbers using Python programming.
13. Program the Raspberry Pi to control light emitting diodes (LEDs) and to get feedback from a switch connected to the GPIO pins.
14. Program the Raspberry Pi to get the temperature from a sensor connected to the GPIO pins.
15. Program the Raspberry Pi to detect room light from a photocell sensor connected to the GPIO pins.
16. Program the Raspberry Pi for Motion detection using Raspberry pi.
17. Program the Raspberry Pi for interfacing the DHT11 sensor.
18. Program the Raspberry Pi for interfacing the Ultrasonic sensor.
19. Program the Raspberry Pi for water level monitor.

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU3301

Course Name: Advanced Discrete Mathematics

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set, Logic, Permutations, Combinations, Counting principles, Algebra of equations, Properties of integers.

Course Objectives: To study

- Number theoretic problems using division algorithm for integers
- Euler's theorem and Fermat's theorem.
- Congruence relations on the set of integers.
- Permutations and combinations and its properties.
- First and second principle of Mathematical induction
- Posets, Lattices and types of lattices.
- Linear homogeneous recurrence relations.

Course Outcomes:

On completion of the course, student will be able to:-

- Find greatest common divisor of two integers
- Solve problems based on concept of Prime Integers
- Solve problems based on Residue classes.
- Find a remainder when one (relatively large) integer is divided by another (small integer)
- Solve problems based on counting principles.
- Check whether given set is a partially ordered set or not
- Check whether the given set is a lattice or not.

- Formulate a recurrence relation for recursive algorithm of a given real life situation
- Solve linear homogeneous recurrence relation.

Course Contents:

Chapter 1	**Divisibility of integers**	**10 Hours**
	● Division algorithm. ● Divisibility and its properties ● Primes ● Definition G.C.D. and L.C.M., Expressing G.C.D. of two integers as a linear combination of the two integers. ● Euclidean algorithm. ● Relatively prime integers, Euclid lemma and generalization. ● Congruence relations and its properties, ● Residue classes: Definition, Examples, Addition and multiplication modulo n and composition tables. ● Euler's and Fermat's theorems, Examples.	
Chapter 2	**Counting Principles**	**10 Hours**
	● Cardinality of a Set: Cardinality of a finite set. ● Basics of Counting: The Sum Rule, the Product Rule, the Inclusion-Exclusion Principle. ● The Pigeonhole Principle: Statement, the Generalized Pigeonhole Principle, Its Applications. ● Permutations and Combinations : Permutation and Combination with Repetitions, Permutations with Indistinguishable Objects, Distributing objects into boxes: Distinguishable objects and distinguishable boxes, Indistinguishable objects and distinguishable boxes, Distinguishable objects and Indistinguishable boxes, Indistinguishable objects and Indistinguishable boxes ● Method of first and second principle of Mathematical Induction, Examples.	
Chapter 3	**Lattices and Boolean Algebra**	**5 Hours**
	● Poset, Hasse diagram. ● Lattices, Complemented lattice, Bounded lattice and Distributive lattice – Definition and examples. ● Boolean Algebra	

Chapter 4	Recurrence Relations	5 Hours
	● Recurrence Relations: Introduction ● Modeling with Recurrence Relation ● Linear Recurrence Relations with constant coefficients. ● Homogeneous Solutions.	
	Total No. of Hours	**30**

Reference Books:

1) Discrete Mathematics and its Applications by Kenneth Rosen, Tata McGraw Hill (Seventh edition), 2011.

2) Discrete Mathematical Structures by Kolman, Busby and Ross, PHI Publications, (Sixth edition), 2009.

3) Elements of Discrete Mathematics by C. L. Liu and D. P. Mohapatra, Tata McGraw Hill (fourth edition), 2013.

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU3302

Course Name: Lab Course on 24CsMatU3301 Advanced Discrete Mathematics

Teaching Scheme: PR: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set, Logic, Permutations, Combinations, Counting principles, Algebra of equations, Properties of integers.

Course Objectives: To study

- Number theoretic problems using division algorithm for integers
- Euler's theorem and Fermat's theorem.
- Congruence relations on the set of integers.
- Permutations and combinations and its properties.
- First and second principle of Mathematical induction
- Posets, Lattices and types of lattices.
- Linear homogeneous recurrence relations.

Course Outcomes:

On completion of the course, student will be able to:-

- Find greatest common divisor of two integers
- Solve problems based on concept of Prime Integers
- Solve problems based on Residue classes.
- Find a remainder when one (relatively large) integer is divided by another (small integer)
- Solve problems based on counting principles.
- Check whether the given set is a partially ordered set or not
- Check whether the given set is a lattice or not.
- Formulate a recurrence relation for recursive algorithm of a given real life situation

- Solve linear homogeneous recurrence relation.

Course Contents:

	List of Practicals	**60 Hours**
Practical 1	Divisibility	
Practical 2	Prime Numbers	
Practical 3	Euclidean Algorithm	
Practical 4	Congruence Relation	
Practical 5	Euler's and Fermat's Theorems	
Practical 6	The Pigeonhole Principle	
Practical 7	Permutations and Combinations (with, without repetitions)	
Practical 8	Distributing objects into boxes	
Practical 9	The Inclusion-Exclusion Principle	
Practical 10	Mathematical Induction	
Practical 11	Partially Ordered Sets	
Practical 12	Lattices	
Practical 13	Boolean Algebra	
Practical 14	Formation of Recurrence Relation	
Practical 15	Solution of Linear Homogeneous Recurrence Relations	

Note: For every batch there will be 4 hours for each practical session per week.

Reference Books:

1) Discrete Mathematics and its Applications by Kenneth Rosen, Tata McGraw Hill (Seventh edition), 2011.

2) Discrete Mathematical Structures by Kolman, Busby and Ross, PHI Publications, (Sixth edition), 2009.

3) Elements of Discrete Mathematics by C. L. Liu and D. P. Mohapatra, Tata McGraw Hill (fourth edition), 2013.

Detailed Syllabus
Sem - IV

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

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Second Year of B.Sc. (Computer Science)

(2024 NEP Course)

Course Code: 24CsCmpU4101

Course Title: Advanced Data Structures

Teaching Scheme: TH: **Credit: 2**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Prerequisites:

Student must be aware of Basic Data Structures such as Arrays, Linked List, Stack and Queue

Objectives:

- Study of various complex data structures at logical, implementation and application level.

Course Outcome:

- Understand Data Structures and their effective and efficient use in solving complex problems.
- Students will able to improve their problem-solving ability by using data structures.

Course Contents:

Unit 1	**The Linked List**	**8 lectures**
	1.1 Concept of pointers and dynamic memory allocation 1.2 Definition and Operations 1.3 Singly linear and circular linked list 1.4 Doubly linear and circular linked list 1.5 Implementation of stack and queue using linked list	
Unit 2	**Binary Trees**	**8 lectures**
	2.1 Definition, Concepts and Terminologies, Operations (including inorder, preorder, postorder and bfs) 2.2 Representation of Binary trees using Array and Linked List 2.3 Application of Binary Tree – Binary Search Tree 2.4 Tree sorting - Binary Tree Sort, HeapSort with efficiency comparison	
Unit 3	**Hashing**	**6 lectures**

	3.1 Concept and Terminologies 3.2 Hashing with and without Chaining 3.3 Efficiency considerations	
Unit 4	**Graphs**	**8 lectures**
	4.1 Concept and Terminologies 4.2 Static and Linked Representations 4.3 Operations including Depth First and Breadth First Traversal 4.4 **Applications** – Activity of Vertex(AOV) and Activity on Edges (AOE)	

Reference Books:

1. Data Structures Using C and C++ By Yedidyah Langsam, Moshe J. Augemstein, Aaron M. Tanenbaum.
2. Data Structures A Pseudocode Approach with C By Richard F. Gilberg and Behrouz A. Forouzan

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S.Y. B. Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU4102
Course Name: Advanced Database Management System

Teaching Scheme: TH: 2 Hours/ Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites

- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics of relational design
- Basics of ER model

Course Objectives

- To introduce fundamental concepts of RDBMS (PL/PgSQL)
- To understand the Database Management activities like transaction processing and concurrency control.
- To understand the importance of database integrity and data security
- To understand crash recovery concepts with its importance
- To introduce different types of databases

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall E-R Model and convert the same into database tables.	1
CO 2	Demonstrate and apply database techniques using PL/pgSQL.	2
CO 3	Apply transaction Management in relational database System.	3
CO 4	Classify different database integrity and security methods.	4
CO 5	Determine crash recovery techniques.	5
CO 6	Elaborate different types of databases.	6

Course Contents

Unit 1	**Relational Database Design Using PLSQL**	**10 lectures**
	1.1 Introduction to PL support in SQL 1.2 Plpgsql: Datatypes, Language structure 1.3 Conditional statements, loops 1.4 View structure and its usage 1.5 Stored Functions 1.6 Handling Errors and Exceptions 1.7 Introduction to Cursors 1.8 Introduction to Triggers	
Unit 2	**Concepts of Transaction, Concurrency control**	**8 lectures**
	2.1 Describe a transaction, properties of transaction, state of the transaction. 2.2 Executing transactions concurrently associated problem in concurrent execution. 2.3 Schedules, types of schedules, concept of Serializability, Precedence graph for Serializability. 2.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations. 2.5 Starvation, Deadlock and deadlock handling.	
Unit 3	**Database Integrity and Security Concepts**	**6 lectures**
	3.1 Introduction to database security concepts 3.2 Methods for database security 3.3 Access control method 3.4 Overview of encryption technique or security 3.5 Statistical database security	
Unit 4	**Crash Recovery**	**4 lectures**
	4.1 Failure classification 4.2 Recovery concepts 4.3 Log based recovery techniques (Deferred and Immediate update) 4.4 Checkpoints, Relationship between database manager and buffer cache. 4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit)	
Unit 5	**Introduction to Advanced Databases**	**2 lectures**

	5.1 Parallel and distributed Databases 5.2 Object Based Databases 5.3 XML Databases 5.4 NoSQL Database 5.5 Multimedia Databases	

References

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan, ISBN:9780071289597, Tata McGraw-Hill Education
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
3. Database Systems, Shamkant B. Navathe, RamezElmasri, ISBN:9780132144988, Pearson Higher Education
4. Practical Postgresql , By Joshua D. Drake, John C Worsley, O'Reilly publications
5. An introduction to Database systems, Bipin C Desai, Galgotia Publications
6. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
7. An Introduction to Database Systems", C J Date, Addison-Wesley
8. Database Systems : Concepts, Design and Application", S.K.Singh, Pearson, Education
9. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence: by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
10. MongoDB: The Definitive Guide , Kristina Chodorow, Michael Dirolf, O'Reilly Publications

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S.Y. B.Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU4103
Course Name: Lab Course on 24CsCmpU4101 and 24CsCmpU4102

Teaching Scheme: PR 4 Hours/ Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites

- Student must be aware of Basic Data Structures such as Arrays, Linked List, Stack and Queue.
- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics of relational design.

Course Objectives:

- Study of various complex data structures at logical level.
- To implement advanced data structures at application level.
- To introduce advanced concepts of RDBMS.
- To implement RDBMS concepts using PostgreSQL.

Course Contents:

Sr.No	**List of practical**
1	Write a C program to implement linked list.
2	Write a C program to implement circular linked list.
3	Write a C program to implement doubly linked list.
4	Write a C program to implement doubly circular linked list.
5	Write a C program to implement stack implementation using linked list.
6	Write a C program to implement queue implementation using linked list.
7	Write a C program to implement Binary search Tree with all traversing operations.
8	Write a C program to implement Binary search Tree to Count number of leaf nodes Count number of non-leaf nodes
9	Write C program to implement Binary Search Tree to Create its mirror Check whether two trees are mirrors
10	Write a C program to implement Hashing (Linear probing)

11	Write a C program to implement Hashing (Separate chaining).
12	Write a C program to implement Graph using adjacency matrix and calculate in-degree and out – degree for each node.
13	Write a C program to convert adjacency matrix to adjacency list.
14	Assignment on Nested Queries using PostgreSQL.
15	Assignment to write views on the given databases.
16	Assignment to write functions on the given databases.
17	Assignment to write functions using exceptions and error handling on the given databases.
18	Assignment to write functions using cursors on the given databases.
19	Assignment to write triggers on the given databases.

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S.Y. B.Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU4501

Course Name: Lab on OOP using C++ (VSC P)

Teaching Scheme:PR : 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Knowledge of C Programming Language

Course Objectives:

- Acquire an understanding of basic object-oriented concepts and the issues involved in effective class design
- To learn the syntax and semantics of the **C++** programming language.
- In order to write C++ programs that use object-oriented concepts such as information hiding, constructors, destructors, inheritance etc.

Course Contents:

Sr.No	List of practical
1	Write C++ program using basic concepts of C++.
2	Write C++ program using Class, Object, and Array of objects.
3	Write C++ program using function in C++.
4	Write C++ program using Function Overloading.
5	Write C++ program using Constructors and Destructors.
6	Write C++ program to implement Operator Overloading.
7	Write C++ program to implement Inheritance.
8	Write C++ program to implement Virtual base class.
9	Write C++ program to implement Virtual functions.
10	Write C++ program using File Handling concepts.
11	Write C++ program to implement Exception Handling
12	Write C++ program to implement Templates.

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Second Year of B. Sc (Computer Science) Electronics Revised NEP2020 (2024)

SEMESTER IV

Course Code: 24CsEleU4301 Minor: Theory

Course Name: Analog and Advanced Digital Communication

Teaching Scheme: Th: 2 Hours/Week **Credit:** 02
Examination Scheme: CIA: 20 Marks **End-Sem :** 30 Marks

Course Objectives

1. To study the basics electronic communication system.
2. To study the different analog modulation types.
3. To study antenna and its parameters.
4. To study different digital modulation types.

Course outcomes on completion of the course, student will get the

1. Ability to understand the basic concepts of digital communication system.
2. Understanding the characteristics of analog and digital communication.
3. Ability to understand of modulators and demodulators.
4. Multiplexing and Demultiplexing concepts in electronic communication system.
5. Understanding antenna and its parameters.
6. Ability to understand mathematical formulation of modulation.

Analog and Advanced Digital Communication		
Unit 1	**Basics of Electronic Communications** Concept of communication, Block diagram of electronic communication system, Types of Electronic communications, Communication concepts- Bandwidth, signal bandwidth, channel bandwidth, channel capacity, relation between channel capacity and bandwidth, Nyquist theorem, signal to noise ratio, Shannon theorem.	**04**
Unit 2	**Modulation and Demodulation** Introduction to concepts of modulation and demodulation, Modulation techniques: Analog modulation: Concept of Amplitude, Phase and Frequency modulation, Detail study of amplitude modulation (working of transistorized amplitude modulator and diode demodulator. Equation of amplitude modulated wave, modulation index and frequency spectrum), Frequency modulation circuit using transistor. Digital modulation: Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Block diagram and working, delta modulation circuit, MODEM - concept of ASK, FSK, BPSK, QPSK, QAM , OFDM and block diagram of MODEM using FSK.	**14**

Unit 3	**Multiplexing and Multiple Access Techniques** Study of multiplexing and multiple access techniques: Space division multiplexing, Time division multiplexing, Frequency Division Multiplexing, Code division multiplexing, Spread spectrum techniques: DSSS, FHSS, Introduction to multiple access and corresponding access types: FDMA, TDMA, and CDMA.	**6**
Unit 4	**Introduction to Wireless Communication** Introduction to wireless communication system. Need of wireless communication Systems. Antenna – Introduction, Need, working Principle, Parameters of antenna: Gain, directivity, Radiation pattern, Beam width, Bandwidth, front to back ratio (FBR). Study of micro strip patch antenna: design and applications. Beam steering application of Antenna.	**6**

Reference Books:

1. Communication Electronics: Principles and Applications. L. E. Frenzel 3rd Edition .
2. Modern Electronic Communication. G.M. Miller 7th Edition.
3. Mobile Communication Jochen Schiller 2nd Edition.
4. Wireless Communications: Principles and Practice Rappaport.
5. Wireless Communications and Networks. William Stallings.

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Second Year of B. Sc (Computer Science) Electronics Revised NEP2020 (2024)

SEMESTER IV

Course Code: 24CsEleU4302 **Minor: Practical**
Course Name: Lab course on 24CsEleU4301 (Analog and Advanced Digital Communication**)**

Teaching Scheme: PR: 4 Hours/Week **Credit:** 02
Examination Scheme: CIA: 20 Marks **End-Sem :** 30 Marks

Course Objectives

1. To study the different analog modulation types.
2. To study antenna and its parameters.
3. To study different digital modulation types.

Course outcomes on completion of the course, student will get the

1. Ability to design and build the amplitude modulator and demodulator.
2. Understanding to build and test different multiplexing circuits.
3. Understanding the antenna parameters.
4. Ability to measure and record the experimental data, analyze the results, and prepare a formal laboratory report.
5. Understanding of spread spectrum techniques.
6. Understanding of tuned amplifiers

List of Experiments

1. To design an Amplitude Modulator using Transistor and demodulator using diode.
2. To study Time Division Multiplexing (TDM).
3. To study Pulse Amplitude Modulation (PAM).
4. To study Pulse Width Modulation (PWM).
5. To study Pulse Position Modulation (PPM).
6. To study FSK modulator.
7. To Study of PN sequence generator.
8. To Study of Analog multiplexer using IC 4051.
9. To Study BPSK modulator.
10. To study antenna parameters.

11. To study Delta modulator.
12. To study FM modulator.
13. To study FM receiver.
14. To study tuned amplifier circuit.
15. To study wireless communication link using 433 MHz transceiver

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU4301

Course Name: Groups and Coding Theory

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set theory, Matrix Algebra.

Course Objectives: To study

- Binary operations
- Semigroup and monoid
- Group
- Types of groups
- Coding theory
- Cryptography

Course Outcomes: On completion of the course, student will be able to:-

- Learn binary operations
- Understand group structure
- Solve problems based on types of groups
- Understand encoding and decoding process
- Detect errors in coding and decoding
- Study Public Key Cryptosystem

Course Contents:

Chapter 1	**Introduction to Algebraic Structures**	**6 Hours**

	● Binary Operations: Definition and Examples ● Semigroup, Monoid: Definition and Examples ● Group: Definition, examples, properties	
Chapter 2	**Types of groups**	**10 Hours**
	● Subgroups ● Cyclic groups ● Abelian,group ● Permutation group ● Normal subgroups ● Quotient Groups: Definition, examples, Properties	
Chapter 3	**Coding Theory**	**8 Hours**
	● Coding of Binary information and error detection ● Decoding and Error correction	
Chapter 4	**Cryptography**	**6 Hours**
	● RSA public key cryptosystem ● Discrete Log	
	Total No. of Hours	**30**

Reference Books:

1) Contemporary Abstract Algebra -Joseph A. Gallian

2) Discrete Mathematical Structures -Kolman, Busby,Ross

3) Applied Discrete Structures for Computer Science-Alan Doerr and Kenneth Levasseur.

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU4302

Course Name: Lab Course on 24CsMatU4301

Teaching Scheme: PR: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set theory, Matrix Algebra.

Course Objectives:

To study

- Binary operations
- Semigroup and monoid
- Group
- Types of groups
- Coding theory
- Cryptography

Course Outcomes:

On completion of the course, student will be able to:-

- Learn binary operations
- Understand group structure
- Solve problems based on types of groups
- Understand encoding and decoding process
- Detect errors in coding and decoding
- Study public key Cryptosystem

Course Contents:

	List of Practicals	60 Hours
Practical 1	Problem based on Binary Operation.	
Practical 2	Problem based on Semigroups and Monoids.	
Practical 3	Problem based on Groups	
Practical 4	Problem based on Subgroups, Cyclic groups	
Practical 5	Problem based on permutation group.	
Practical 6	Problem based on Normal Subgroups, Quotient Groups.	
Practical 7	Coding Theory I	
Practical 8	Coding Theory II	
Practical 9	Detection of error problems.	
Practical 10	Correction of error problems.	
Practical 11	Cryptography Simple problems	
Practical 12	RSA cryptosystem problems	
Practical 13	Discrete Log	
Practical 14	Miscellaneous Problem set I (Binary Operation,Semigroup, Monoid, Groups)	
Practical 15	Miscellaneous Problem set II (Coding, Cryptography)	

Note: For every batch there will be 4 hours for each practical session per week.

Reference Books:

1) Contemporary Abstract Algebra -Joseph A. Gallian

2) Discrete Mathematical Structures -Kolman, Busby,Ross

3) Applied Discrete Structures for computer Science-Alan Doerr and Kenneth Levasseur.

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Second Year of B. Sc. Computer Science

(Course under NEP 2020)

Course Code: 24CsStaU4601

Course Name: Data Mining (Machine Learning)

Teaching Scheme: 2 Hours/Week **Credit: 2**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites:

1. Basic knowledge of Probability, Linear Algebra and Statistics
2. Basic knowledge of programming language

Course Objectives:

- To get knowledge by self-study, observation, experience and/or by being taught.
- Data mining deals with the design, analysis and validation of algorithms that enable computers (machines) to learn from data and automatically extract methods to perform intended tasks.
- The main objective of this course is to introduce some standard learning algorithms for tasks such as classification, regression, clustering, outlier detection and association finding.
- To apply data mining techniques for problem solving.
- To use tools and techniques for understanding concept of data mining

Course Outcomes:

On completion of the course, student will be able to:

1. Understand a wide variety of data mining tool.
2. Ability to analyze the data using various data mining tool or various machine learning algorithm
3. Ability to design and implement a learning model
4. Understand how to perform evaluation of learning algorithms and model selection
5. Ability to tackle real world problems of data mining.

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	**Introduction to Data mining**	**7**

	1.1 What is Data mining? 1.2 Applications of data mining. 1.3 Steps in developing learning system, Data preprocessing, Missing data, categorical data, feature scaling, training set vs. test set, Data Modeling phases 1.4 Types of learning - Supervised learning, Unsupervised learning, Semi-supervised learning 1.5 Dimensionality reduction- Introduction to dimensionality reduction, Subset selection, Principal Component Analysis(PCA), Factor analysis. 1.6 Case studies	
nit 2	**Supervised Learning**	**10**
	2.1 Supervised learning 2.2 Learning with Classification - Decision Tree, Support Vector Machine, Naive Bayes, K-Nearest Neighbors, Logistic regression 2.3 Learning with Regression - Simple Linear regression, Multiple linear Regression 2.4 Evaluating model performance - False positives, False negatives Confusion matrix, Accuracy, Precision, Recall, Cross Validation and Comparison 2.5 Regression Matrices R- Square, Adjusted R Square 2.6 Classification and Evaluation Matrix 2.7 Case studies	
Unit 3	**Unsupervised Learning**	**8**
	3.1 Un-supervised learning 3.2Clustering algorithms - K-means clustering, Hierarchical clustering 3.3 Rule based learning - Association rule mining, Apriori, Support and Confidence parameters and Comparison 3.4 Case studies	
Unit 4	**Learning with Neural Network**	**5**
	4.1 Limitations of Machine Learning 4.2 What is Deep learning? 4.3 Artificial Neural network - Neurons, Activation function, Perceptron learning algorithm, training of perceptron 4.4 Case studies.	

References:

1. Berson and Smith S.J. (1997): Data warehousing, Data Mining, and OLAP, McGraw-Hill.
2. Breiman J.H Friedman, R.A. Olshen and stone C.J. (1984): Classification and Regression Trees, Wadsworth and Brooks / Cole.
3. Han, J. and Kamber, M. and Pei, J. (2012): Data Mining: Concepts and Techniques. MorganGaufmann.3rd Edition.
4. Mitchell T.M. (1997): Machine Learning, McGraw-Hill.
5. Ripley B.D. (1996): Pattern Recognition and Neural Networks. Cambridge University Press.
6. Vapnik V.N. The nature of Statistical learning theory, Springer.
7. Cristianini N. and Shawe-Taylor J. An Introduction to support vector machines.
8. Mehrika, K., Mohan, C., and Ranka (1997) Elements of Artificial neural networks. Penram international.
9. Hastie T, Tibshirani R, Friedmant J, (2009): The elements of statistical Learning, Springer.
10. Chattamvelli, R. (2015). Data mining methods. Alpha Science International