LOYOLA ACADEMY

(DEGREE & PG COLLEGE)
OLD ALWAL, SECUNDERABAD - 500 010, TELANGANA, INDIA
(Autonomous and Affiliated to Osmania University)
Re-accredited with 'A' Grade (III Cycle) by NAAC
A "College with Potential for Excellence" by UGC
www.loyolaacademy.edu.in Ph: 040-27862363/27860077 Fax: 040-27867939

SCHOOL OF INFORMATICS

Department of
B.Sc. Computer Science & Cyber Security

Year of Inception:2021

Academic Year: 2024-25 for the batch 2024-27

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SYLLABUS

Of

B.Sc.Computer Science and Cyber Security

For the Academic Year 2024-2025

Chairman
Board of Studies

Dean
School of Informatics

Principal

Department of

B.Sc.Computer Science and Cyber security

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PO1: Scientific Knowledge. Apply the knowledge of Science, Mathematics, Engineering & Technology fundamentals to solve the complex problems**.**

PO2:**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO3: Problem analysis: Identify, formulate, research literature, and analyse complex scientific problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO4: Modern tool usage: Create, select and apply appropriate techniques, resources, and modern technology and IT tools to complex science and technological activities.

PO5: Environment and sustainability: Understand the impact of professional science and technological solutions in societal and environmental contexts and for sustainable Development.

PO6: Individual and team work: Function objectively as an individual and as a member in diverse teams.

PO7: Communication: Communicate effectively on complex science & technology activities with society at large and able to write effective reports and documentation.

PO8. Life-long learning: Recognize the need and ability to engage in independent and lifelong Learning in the context of technological change.

Students will be able to:

PSO1: Apply computer science languages and algorithms, as well as mathematical and statistical models for developing solutions to real world problems.

PSO2: Understand the fundamentals of Computer Organisation, Operating Systems and networking related concepts and apply the knowledge of computer systems in designing and building software solutions.

PSO3: Demonstrate, identify, formulate and analyse diverse big data problems helping in business decision making. Apply supervised and unsupervised machine learning methodologies.

PSO4: Apply appropriate Data Mining and Text Mining techniques for cleaning, processing and transforming the data. Analyse and interpret the data using an ethically responsible approach and derive insights from it.

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SCHEME- B.Sc. COMPUTER SCIENCE AND CYBER SECURITY-2024-25 of Batch 2024-27

Year	Sem	Course-1	Course-2	Course-3	Course-4	Course-5	Course-6	Hours	Credits	
I	I	General English-I (3T) **(AECC-1)(3)**	Value Education & Personality Development (2T)(2) **(AECC-2)**	Computer Fundamentals (4T+2P)(5) **(SEC-1)**	Elementary Number Theory & Laplace Transforms(5T) **(DSC-1)(4)**	Computer Networks (4T+2P) **(DSC-2)(5)**	Problem Solving and Programming in C (5T+2P) (DSC-**3**)(5)	29	24	AECC=2 SEC=1 CORE=3
	II	General English-II (3T) **(AECC-3)(3)**	Indian Heritage and Culture (2T) **(AECC-4)(2)**	Server Administration (4T+2P) **(SEC-2)(5)**	Matrices and vector calculus(5T) (DSC-4)(4)	Operating System(4T+2P) **(DSC-5)(5)**	Data Structures with C (5T+2P) **(DSC-6)(5)**	29	24	AECC=2 SEC=1 CORE=3
II	III	Environmental Studies & Gender Sensitization (3) **(AECC-5)(3)**	(2+1) **(GE-1)***	Ethical Hacking (4T+2P)**(DSC-7)(5)**	Cryptographic Algorithms(4T) **(DSC-8)(4)**	Database Management System(4T+2P) **(DSC-9)(5)**	Python Programming (4T+2P) **(SEC-3)(5)**	29	25	AECC=1 GE=1 CORE=3 SEC=1
	IV	Discrete Mathematics(4)**(GE-2)(4)**	Computer Forensics(4T) **(DSC-10)(4)**	Cyber Ethics and IPR(4) **(DSC-11)(4)**	Principles of information security(4T+2P) (5)**(DSC-12)**	Network Security **(4+1) (DSC-13)(5)**	Python Scripting (4+1) (DSC-**14**)(5)	30	27	GE=1 CORE=5
III	V	Steganography/ Secure ECommerce(4T) (**DSE-1**)(4)	Internet of Things /Distributed Systems(4T) (**DSE-2**)(4)	Go Lang(4T+2P) **(DSC-15)(5)**	Machine Learning (4T+2P) **(DSC-16)(5)**	Database Security(4T+2P) (DSC-**17**)(5)	Disaster Recovery and Risk Management (4T) **(DSC-18)(4)**	30	27	DSE=2 CORE=4
	VI	Cyber Threat Intelligence /Block chain and cryptocurrency(3T) (**DSE-3**)(3)	Web Application Testing (4T+2P) **(Sec-4)(5)**	Cloud Computing (3T+2P) **(DSC-19)(4)**	Project Work (6) **(DSE-4)**			30	18	DSE=2 SEC=1 CORE=1

Legend:
1. Ability Enhancement Compulsory Course (AECC) : 05
2. Generic Elective (GE) : 02
3. Skill Enhancement Course (SEC) : 03
4. Discipline Specific Course : 19
5. Discipline-Specific Elective (DSE) : 03

*Principles of Information security

Total **177** **145**

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YEAR AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
B.Sc.COMPUTER SCIENCE AND CYBER SECURITY
I YEAR I SEMESTER
ACADEMIC YEAR 2024-25 FOR THE BATCH 2024-27

SL. No.	Part No.	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs.)	Marks			Credits
						Internal	External	Total	
1	I	EN23101	General English-I (AECC-1)	3	3	40	60	100	3
2	I	VE18101	Value Education & Personality Development (VAC-1)	2	3	40	60	100	2
3	II	BS24103	Computer Fundamentals (SEC-1)	4	3	40	60	100	4
4	II	BS24101	Elementary Number Theory & Laplace Transforms (DSC-1)	5	3	40	60	100	4
5	II	BS24102	Computer Networks (DSC-2)	4	3	40	60	100	4
6	II	BS24104	Problem Solving and Programming in C (DSC-3)	4	3	40	60	100	4
	PRACTICALS								
7	II	BS24105	Office Automation-Lab (SEC-1)	2	3	40	60	100	1
8	II	BS24106	Computer Networks Lab (DSC-2)	2	3	40	60	100	1
9	II	BS24107	C Programming-Lab (DSC-3)	2	3	40	60	100	1
	Total			**29**	**-**	**360**	**540**	**900**	**24**

***Ability Enhancement Compulsory Course (AECC)**
*** Skill Enhancement Compulsory Course (SEC)**
***Value added Course(VAC)**
*** Discipline Specific Course(DSC)**

GENERAL ENGLISH -I

Credits : 3 **Semester : I**
Subject Code: EN23101 **No of Lecture Hours: 45**

Objectives:

- Through an exposure to contemporary passages, the students would be able to have a grasp on the language of today, with specific emphasis on the Listening, Speaking, Reading and Writing skills.
- Through the components of a passage, vocabulary and grammar section, speaking component and writing segments, there is a holistic development for language proficiency and fluency.

Outcomes:

CO1: To distinguish between words which are either spelt or pronounced alike, yet render distinct meanings; imparting a sound clarity on everyday usage of language, and for developing the art of parallel listening and writing.

CO2: To construct vocabulary and to gain understanding on the tense component, a pivotal constituent for language structuring and vocabulary building.

CO3: To identify with economical word constructions, paying specific attention in constructing sound writing skills.

CO4: To interpret functional grammar, the basic part involved in sentence constructing to improve linguistic skills.

CO5: To develop communication skills to provide a platform for language efficiency for effective language deliver

UNIT- I	**9Hrs**
Fundamentals of Communication-I	
Short Story - The Mystery Story (source – teacherluke.co.uk)	1
Present Tense	2
Past Tense	2
Future Tense	2
Paragraph Writing	2

UNIT- II	
Language Proficiency for Effective Writing and Speaking Skills-I	**9Hrs**
Poem- Goodbye Party For Miss Pushpa T.S. by Nissim Ezekiel	2
Subject- Verb Agreement	3
Punctuations	2
Review Writing	2

UNIT-III	**9Hrs**
Wit and Humour	
From the text Atea Party by Ruth Prawer Jhabvala	
Explanation of the text	2
Grammar -------Nouns, Articles	2
Vocabulary --- Homonyms, Homophones, Homographs	2
Writing Skill ------Note- Making	2

UNIT-IV **9Hrs**

Human Values

From the text "India's Contribution to World Unity"

Explanation of the text 2

Grammar----adverbs 2

Vocabulary----Adjective and Adverb Suffixes 2

Writing Skill------Formal Letters and Curriculum Vitae 2

UNIT-V **9Hrs**

From the text "Sachin Tendulkar"

Explanation of the text 3

Grammar----- Adjectives, Comparison of Adjectives 3

Vocabulary-----Common Errors, Commonly Misspelt words, Commonly Confused Words 3

Writing Skill-----References and Bibliographies

VALUE EDUCATION & PERSONALITY DEVELOPMENT

Credits : 2

Semester : I

Subject code : VE18101 **No. of Lecture Hours: 30**

Objectives:

- To produce intellectually competent, morally upright, socially committed, spiritually inspired citizens in the service of the nation and the world.
- To transform the students into conscientious citizens through holistic education and contribute to nation building.

Course Outcomes:

CO1: **Differentiate** accepted norms and counter values and to identify the various dimensions of Human Development.

CO2: **Demonstrate** Love and Experience of God and identify the Basic Issues of Life and Happiness as a life goal.

CO3: **Understand** the importance of Concern for others and critique the various problems that deter the growth of the society.

CO4: **Recognize** the traits of a good personality and practice Self-exploration.

CO5: **Interpret** the Purpose of Life and Goal Setting and demonstrate Self-management.

UNIT- I

6Hrs

Introduction to Ethics

1. Why Value Education?
2. Reasons to have Ethics for Life
3. Accepted Norms and Counter Values
4. Dimensions of Human Development: Physical, Intellectual, Emotional, Moral, Spiritual and Social

UNIT-II

6Hrs

Approach to Life

1. Conscience and Pseudo-Conscience
2. Happiness as Life-goal
3. Values revealed and lived in Religions
4. Experience of God
5. Love: The three components of Love
6. Some of the basic stages and issues of Life: Family, Love, Sex, Marriage

UNIT-III

6Hrs

Concern for others

1. Self and Another
2. Human Context
3. Moral Problems of a Society / True Society : Social Desire, Social Fear, Social Silence, Social Indifference

UNIT-IV

6Hrs

Transformation of self

1. Definitions of personality
2. Characteristics of personality
3. Elements of personality
4. Traits of good personality

5. Self-Identity, self-concept
6. Self-Discovery, self-acceptance
7. Self-Esteem

WORKSHEET (1): Self Estimation

UNIT-V

6Hrs

Life enrichment Skills

1. Purpose of life - Goal setting
2. Characteristics of Goals
3. Building Relationships
4. Time Management
5. Stress Management
6. Emotional Management
7. Conflict Management
8. Team Management (Group Dynamics)

WORK SHEETS (1) & (2): 1) Anger Management
2) Team Management

ESSENTIAL READING

1. Human Values - Development Programme - AIACHE
2. In Harmony

COMPUTER FUNDAMENTALS

Credits: 4 **Semester : I**
Subject Code : BS24103 **No. of Lecture Hours: 60**

Objective: To understand the basic concepts of computer technologies
Outcome:
CO1: **Understand** various I/O devices and functionality of computer
CO2: **Solve** arithmetic operations using different types of number systems
CO3: **Understand** the concepts of Data Organisation
CO4: Understand the concepts of Internet
CO5: **Explain** the concepts of Problem Solving using Computers

UNIT-I **9Hrs**

INTRODUCTION TO COMPUTERS

1. Definition, characteristics, stored program concept, history and Classification of Computers 2
2. Introduction, classification, System and Application software, Firmware, middle ware, procuring computer software 1

COMPUTER MEMORY

3. Introduction, memory organization, hierarchy, sequential and random access 2
4. Process Registers, Primary memory and cache memory 2
5. 5.Secondary storage devices, Magnetic tapes, Hard disks- external, optical disks 1
6. USB flash drives, Memory Cards, Mass storage devices 1

UNIT- II **9Hrs**

1. Basic Processor Architecture 2
2. Pipelining and Parallel Processing 1
3. Types of Processors **2**
4. Introduction, binary number system- working with binary numbers 1
5. Octal number system- conversions 1
6. Hexadecimal number system- conversions, addition and subtraction 1
7. Signed number representation in binary form 1

UNIT III **9Hrs**

Data Organization

1. Data and File Organization-Sequential, Relative and Indexed Relative 2
2. File-Oriented Approach and Data Base Approach 1
3. Concepts and Components of DBMS ,Introduction to No SQL and
4. Distributed database 2
5. Database Models- Hierarchical,network, Relational, Object oriented 3
6. Data Warehousing- subject-Oriented Data, Integrated data,Non Volatile data, 1

UNIT IV

9Hrs

THE INTERNET

1. Internet-history, intranet and extranet, differences 2
2. IP address- types 1
3. Domain Name System, Uniform resource locator, Internet browsers 2
4. Internet services 1
5. Types of Internet connections 2

6. Internet Security 1

UNIT V

9Hrs

Problem Solving Using Computers

1. Design and Implementation of Efficient Programs 2
2. Program design tools-algorithms, flowcharts,Pseudocodes 2
3. Programming Languages,Generations 1
4. Programming Paradigms-Monolithic,procedural,Structured Programming 2
5. Popular High-level Languages C,C++, Java. Python 1
6. Markup and Scripting Languages , factors affecting selection of Programming Languages. 1

ESSENTIAL READING

1. Thareja, Reema. 2020. **Fundamentals of Computers**. 2nd Edition. Oxford Higher Education.

SUGGESTED READING

1. Sinha Pradeep, K. and Sinha Preeti. 2007. **Computer Fundamentals, Concepts, Systems and Applications.** 4th edition. BPB Publications
2. Rajaraman. 2006. **Fundamentals of Computers.** 4th edition. PHI Publications

COMPUTER NETWORKS

Credits: 4 **Semester: I**

Subject Code: BS24102 **No. of Lecture Hours: 60**

Objectives:

- To get familiarised with fundamental concepts of computer networks.
- To gain expertise in various layers of the TCP/IP model.

Course Outcomes:

CO1: **Identify** basic computer network topologies and protocols and explain Data Communication System components
CO2: **Classify** different error detecting techniques.
CO3: C**onstruct** subnetting and routing mechanisms.
CO4: **Sketch** the routing protocols and analyse how to assign the IP addresses for the given network
CO5: **Develop** network design and implementation

UNIT-I **12Hrs**

1. Introduction: Data Communications, networks, Protocols and Standards 2
2. TCP/IP Protocol suite 3
3. Analog and Digital, Transmission impairments 2
4. Transmission Media-Guided media, Connecting Devices 2
5. Digital Transmission- digital-to-digital conversion 1
6. Multiplexing: Frequency-division, Wavelength and Time Division 2

UNIT-II **12Hrs**

DATA LINK LAYER

1. Error detection and correction-Parity, check sum, CRC, Hamming code 3
2. Data Link Control: Framing, flow and error control 2
3. Stop-and-wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Piggybacking 3
4. HDLC, Random Access- ALOHA, CSMA, CSMA/CD, CSMA/CA 2
5. Wired LANs- Ethernet 2

UNIT-III **12Hrs**

NETWORK LAYER

1. IP address space- Introduction 2
2. Classful and Classless addressing, subnetting and supernetting 3
3. IPv4- datagram, Fragmentation, checksum, options 2
4. Internet Control Protocols- ICMP, IGMP, ARP and RARP 3
5. Delivery, Forwarding, Unicast routing protocols- RIP, OSPF, BGP 2

UNIT-IV **12Hrs**

TRANSPORT LAYER

1. Process-to-Process Delivery, UDP-well known ports, user datagram,
2. checksum 2
3. UDP Operation, use of UDP 3
4. TCP- process to process communication, Numbering bytes, TCP services 3
5. Flow control- silly window syndrome, Error Control 2
6. TCP connection, State transition diagram, Congestion control, Timers, Options 2

UNIT-V

12Hrs

APPLICATION LAYER

1. DNS- Namespace, domain name space, distribution of name space 3
2. DNS in internet, resolution, DNS messages, types of records 3
3. TELNET, E-mail- architecture, message transfer agent: SMTP 3
4. Message Access Agent: POP, FTP 3
5. WWW and HTTP- architecture, web documents, HTTP 3

ESSENTIAL READING

1. Forouzan, Beharouz A,2023,7th edition,**Data Communications and Networking**

2. Forouzan, Beharouz A. 2011. **Data Communications and Networking**. 3rd Edition. New Delhi: Tata Mc Graw Hill.(UNIT-I,II)

3. Forouzan, Beharouz A. 2005. **TCP/IP Protocol Suite**. 3rd Edition. New Delhi: Tata Mc Graw Hill.(UNIT-III-V)

SUGGESTED READING

1. Tanenbaum, Andrew S. 2008. **Computer Networks**. 4th Edition. New Delhi: Pearson Education.

PROBLEM SOLVING AND PROGRAMMING IN 'C'

Credits : 4 **Semester: I**
Subject Code :BS24104 **No. of Lecture Hours: 75**

Objective: To understand major programming constructs this serves as the basis for any programming language.

Course Outcomes:

CO1: **Explain Basic** concepts of C programming
CO2: **Develop** programs using 'C' control structures.
CO3: **Organize** data using arrays and strings
CO4: **Sub divides** larger problems into smaller ones using 'C' functions.
CO5: **Create** programs using the concept of structures, union and file handling in 'C'.

UNIT – I

	12Hrs
Introduction to C programming	2
Structure of C program	2
Files used in a C program	3
Compiling and executing C program	2
C tokens, Constants, Character set in C, Keywords	2
Identifiers	1

UNIT – II **12Hrs**

Data Types in C, Enumerated data types, typedef	2
Variables and scope of a variables	2
Data input and output statements in C	2
Operators and expressions	2
Type conversion and Type Casting	2
Conditional Branching Statement – if, if-else, if-else-if, switch case	2

UNIT – III **12Hrs**

Iterative Statements – while loop, do-while loop, for loop	2
Nested loops, break and continue statements, goto statement	2
Arrays - Single and double dimensional arrays	2
String- string input output functions	3
string manipulation functions	3

UNIT-IV **12Hrs**

Function- Declaring, defining and invoking functions	2
Categories of functions-Built-in functions	2
Passing parameters to functions – call by value & call by reference	2
Storage classes	1
Recursion.	1
Pointers - Declaration, passing pointer to functions	2
Pointers and one dimensional arrays	1
Dynamic memory allocations.	1

UNIT – V **12Hrs**

Structures - Simple structures, nested structure, Array of structures	2
Unions-Differences between Structures and Unions.	2
File handling - Various modes, File operations – fopen(), fclose()	2
File input output functions – fputc(), fgetc(), fputs(), fgets(), getw(), putw(), getc(), putc(), fprintf(), fscanf(), getchar(), putchar()	3
Random accessing file – fseek(), ftell(), rewind()	3

ESSENTIAL READING

1. TharejaReema.,**Programming in C**-2016,2nd Edition

2. TharejaReema. 2016. **Programming in C.** 2nd edition**.** New Delhi : OUP.

3. Kanetkar Yashwant. 2018. **Let us C.** 16th Edition**.** New Delhi : BPB.

4. Gottfried Byron. 2010. **Programming with C (**Schaum's Outline Series**).** 3rd Edition. New Delhi: McGraw Hill Education

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ELEMENTARY NUMBER THEORY AND LAPLACE TRANSFORMS

Credits : 4 **Semester : I**
Subject Code: BS24101 **No. of Lecture hours:75**

Objective:

- To enable students to understand the study of the basic structure and properties of integers. Learning Number Theory helps improving one's ability of mathematical thinking.
- Laplace transforms enable the students to simplify a given LDE (linear differential equation) to an algebraic equation, which can later be solved using the standard algebraic identities.

Course Outcome:

CO1: Solve challenging problems in Number Theory.
CO2: **Demonstrate** knowledge and understanding of topics including divisibility, prime numbers, congruence's, Diophantine equations.
CO3: **Identify** methods and techniques used in number theory.
CO4: **Develop** a deeper conceptual understanding of the theoretical basis of number theory and cryptography.
CO5: Calculate the Laplace transform, Inverse Laplace Transform of standard functions.

UNIT-I **15 Hrs**

Early Number Theory	
Divisibility- The Division algorithm	4
Euclid' algorithm- The Diophantine equation axe + by = c	4
Greatest Common Divisor - Properties of G.C.D	4
Primes – Fundamental theorem of Arithmetic.	3

UNIT-II **15 Hrs**

Congruences – Properties- Applications of Congruences.	3
Linear Congruences - Solutions of Congruences.	4
Fermat's theorem and its applications.	4
Wilson's theorem and its applications.	4

UNIT III **15 Hrs**

The functions τ and σ	3
Euler Totient function $\varphi(n)$	3
Euler's Theorem	2
Some properties of The Phi -function	4
An application to cryptography	3

UNIT IV

15 Hrs

Laplace transforms:

1. Laplace transforms of standard functions	5
2. Shifting Theorems -	5
3. Transforms of derivatives and integrals	5

UNITV **15 Hrs**

Inverse Laplace Transforms

1. Inverse Laplace transforms– Basic Theorems 5
2. Inverse Laplace Transforms by partial Fractions 5
3. Convolution theorem (without proof).(Simple problems there on) 5

ESSENTIAL READING:

1. David M. Burton 2004 **Elementary Number Theory** Universal Book Stall New Delhi
2. A.R. Vasistha Integral Transforms By Krishna PrakashanMandir

OFFICE AUTOMATION LAB

Credits : 1 **Semester : I**
Subject Code : BS24105 **No. of Practical Hours: 30**

Objectives:
To develop applications using Office tools

- Create a news-paper document with at least 200 words,
  - Use margins as, top:1.5, bottom:2, left:2, right:1 inches.
  - Use heading "Gandhi Jayanti", font size: 16, font color: red, font face: Arial Black.
  - With first letter "dropped" (use drop cap option) of the first paragraphcontaining a picture at the right side
  - Use three columns from the second paragraph onwards till the half of thepage.
  - Then use heading "Computer basics"
    - Create paragraph using two columns till the end of the page.
  - Create a Mathematical question paper using, at least five equations
  - With fractions, exponents, summation function
  - With at least one „m*n" matrix
  - Basic mathematical and geometric operators.
  - Use proper text formatting, page color and page border.
- Create a flowchart using,
  - Proper shapes like ellipse, arrows, rectangle, and parallelogram.
  - Use grouping to group all the parts of the flowchart into one single object.
- Create a table using table menu with,
  - At least 5 columns and 10 rows.
  - Merge the first row into one cell.
  - Merge the second row into one cell, then split the second row into threecells.
  - Use proper table border and color.
  - Insert proper content into the table with proper text formatting.
- Create a table using two columns,
  - The left column contains all the short-cut keys and right side columncontains the function of the short-cut keys.
  - Insert a left column using layout option. Name the heading as Serial No.
- Create two letters with the following conditions in Ms Word and find thedifference.
  - Write a personal letter to your friend using at least 100 words and twoparagraphs. The date must be in top-right corner. Use „justify" text- alignment and 1.5 line spacing for the body of the letter. Letter must contain proper salutation and closing.
  - Use step by step mail-merge wizard to design a letter. (Mailing step bystep mail merge wizard letters start from a template select template letters select proper template create new document OK)
- Create a letter, which must be sent to multiple recipients.
  - Use Mail-Merge to create the recipient list.
  - Use excel sheet to enter the recipient.
  - Start the mail merge using letter and directory format. State thedifference.

List of Assignments (MS Excel)

1. Create a table “Student result” with following conditions.
   - The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total,average and result with manual entry.
   - Use formulas for total and average.
   - Find the name of the students who has secured the highest and lowestmarks.
   - Round the average to the nearest highest integer and lowest integer (useceiling and floor function respectively).
2. Do as directed
   - Create a notepad file as per the following fields

   Slno name th1 th2 th3 th4 th5 total % grade
   - Import this notepad file into excel sheet using „data from text“ option.
   - Grade is calculated as,
     - If %>=90, then grade A
     - If %>=80 and <90, then grade B
     - If %>=70 and <80, then grade C
     - If %>=60 and <70, then grade D
     - If %<60, then grade F
3. Create a sales table using the following data,

Item	Year1	Year2	Year3	Year4
Item1	1000	1050	1100	1200
Item2	950	1050	1150	1200
Item3	1100	1200	1200	1300

   - Draw the bar-graph to compare the sales of the three items for four yearsusing insert option.
   - Draw a line-graph to compare the sales of three items for four yearsusing insert option.
   - Draw different pie-charts for the given data using insert option.
   - Use condition, to highlight all the cells having value >=1000 with redcolor (use conditional formatting).

List of Assignments (MS PowerPoint

1. Create a power-point presentation with minimum 5 slides.
   - The first slide must contain the topic of the presentation and name of thepresentation.
   - Must contain at least one table.
   - Must contain at least 5 bullets, 5 numbers.
   - The heading must be, font size:32, font-face: Arial Rounded MT Bold,font-color: blue.
   - The body must be, font size: 24, font-face: Comic Sans MS, font-color:green.
   - Last slide must contain „thank you“.
2. Create a power-point presentation with minimum 10 slides

   a. Use word art to write the heading for each slides.
   - Insert at least one clip-art, one picture
   - Insert at least one audio and one video
   - Hide at least two slides
3. Create a power-point presentation with minimum 5 slides
   - Use custom animation option to animate the text; the text must move leftto right one line at a time.
   - Use proper transition for the slides.

List of Assignments (MS Access)

1. Create a database “Student” with,
    - At least one table named “mark sheet” with field name “student name, rollnumber, mark1, mark2, mark3, mark4, total”
    - The data types are, student name: text, roll number: number, mark1 tomark4: number, total: number. Roll number must be the primary key.
    - Enter data in the table. The total must be calculated using update query.
    - Use query for sorting the table according to the descending/ascendingorder of the total marks.
2. With addition to the table above,
    - Add an additional field “result” to the “mark sheet” table.
    - Enter data for at least 10 students
    - Calculate the result for all the students using update queries, iftotal>=200, then pass, else fail.
    - Search the students, whose name starts with “sh”.
    - Show the names and total marks of the students who have passed theexamination.

Book Recommended:-

1. Computer Course Kit,Comdex 14-lin-1 Vikas Gupta,Dream Tech
2. Master in MS-Office,Bittu Kumar

COMPUTER NETWORKS LAB

Credits: 1 **Semester: I**

Subject Code:BS24106 **No. of Practical Hours: 30**

Objective:

Hands-On training regarding the design ,troubleshooting and evaluation of computer networks

Outcome:

Demonstrate basic switching concepts, VLAN, routing, dynamic and static routing protocols using Cisco packet tracer software (Freeware)

No.ofHrs	Topic
1	Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using crimping tool
2	study the Network Devices in Detail
3	Study of Network IP
4	Connect the Computers in LAN
5	Study of Basic Networking Commands
6	Configure a Network Topology using Packet Tracer
7	Performing an Initial Switch Configuration
8	Performing an Initial Router Configuration
9	Interpreting Ping and Traceroute Output
10	Observing Static and Dynamic Routing
11	Configure a Network Using Distance Vector Routing Protocol
12	Configure a Network Using Link State Vector Routing Protocol

C **PROGRAMING LAB**

Credits: 1 **Semester: I**

Course Code:BS24107

No. of Practical Hours: 30

Objective: To develop applications using structured programming.

Outcome: Students will be able to write, compile and debug programs in C language.

1. Programs to implement various arithmetic operators
2. Programs to find area of circle, area of rectangle, area of square
3. Programs to find gross salary of employee
4. Programs using if, if-else, if-else if –condition statements
5. Program to stimulate calculator using switch case
6. Programs using break and continue
7. Program to print sum of "N" natural numbers
8. Program to print factorial of given numbers using loops
9. Program to print multiplication table of a given number
10. Program to LOYOLA five times
11. Program to find sum of digits and reverse of a given number
12. Program to check if the given number is palindrome or not
13. Program to find the Fibonacci series
14. Program to check the year is leap year or not
15. Program to find swap of two numbers
16. Program to print a pattern
17. Program to solve quadratic equation
18. Programs to display array elements, sum of array elements, smallest, greatest array elements
19. Program to check if the given number is Armstrong number
20. Programs using 2-D array
21. Program to find the element in an array
22. Program to perform operations on matrices (addition, subtraction, multiplication, transpose)
23. Programs using strings and functions
24. Program to find call by value and call by reference
25. Program to find factorial using recursion
26. Program to find the sum of array elements using pointers
27. Program to accept and display book details using structures
28. Program to maintain employee details using structures
29. Program to Read a file and display its content using files
30. Program to count number of space, tabs and newlines in a file

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YEAR AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
B.Sc. COMPUTER SCIENCE AND CYBER SECURITY
I YEAR II SEMESTER
ACADEMIC YEAR 2024-25 FOR THE BATCH 2024-27

Sl. No.	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs.)	Marks			Credits
						Internal	External	Total	
	THEORY								
1	I	EN23201	General English-II (AECC-2)	3	3	40	60	100	3
2	I	IC23201	Indian Heritage & Culture (VAC-2)	2	3	40	60	100	2
3	II	BS24202	Server Administration (SEC-2)	4	3	40	60	100	4
4	II	BS24201	Matrices & Vector Calculus (DSC-4)	5	3	40	60	100	4
5	II	BS24203	Operating Systems (DSC-5)	4	3	40	60	100	4
6	I	BS24204	Data Structures with C (DSC-6)	5	3	40	60	100	4
	Practical								
7	II	BS24205	Server Administration Lab (SEC-2)	2	3	40	60	100	1
8	II	BS24206	Operating System Lab(DSC-5)	2	3	40	60	100	1
9	II	BS24207	Data Structures with C -Lab (DSC-6)	2	3	40	60	100	1
10	III		PLANET* (Outreach)	-	-	-	-	-	1*
	Total			**29**	**-**	360	540	900	**24**

***Ability Enhancement Compulsory Course (AECC)**
***Skill Enhancement Course (SEC)**
***Programme of Loyola Academy for Neighbourhood Empowerment and Transformation (PLANET)**

GENERAL ENGLISH -II

Credits:3 **Semester: II**
Subject Code:EN23201 **No of Lecture Hours: 45**

Objectives:

- To enhance the learners' communication skills by giving adequate exposure in reading, writing, listening and speaking skills and the related sub-skills.
- To develop oral and written communicative skills among the students so that their employ-ability enhances and English becomes the medium of their livelihood and personality.

Outcomes:

CO 1. To identify a sound understanding on the formation of words and to demonstrate the functional grammatical component in the sentence.

CO 2. To paraphrase ideas and thoughts in a coherent, neat and organized manner in order to utilize the writing skills for sound writing propaganda's.

CO3. To create an understanding on Indian Literature, alongside to develop and chisel their communication skills.

CO4.To recognize the moral element which underlies in the short story; an exposure to informal language.

CO5. To develop listening and speaking skills through effective sentence constructions and efficient delivery.

UNIT-I	
Fundamentals of effective communication- II	**9Hrs**
Flash Fiction- The Mice by Lydia Davies	1
1. Simple, Complex and Compound Sentences	3
2. Conversion of sentences	3
3. Information Transfer	2
UNIT-II	**9Hrs**
Language Proficiency for Effective speaking and Writing Skills-II	
Short Story- The Face on the Wall by E V Lucas	2
1. Active and Passive Voice	3
2. Conjunctions	2
3. Essay Writing	2
UNIT-III	**9Hrs**
Health	
From the text "Three Days to See"	
1. Explanation of the text	3
2. Grammar -------Usage of Modal Auxiliary Verbs	2
3. Vocabulary --- Collective Nouns, Technical Vocabulary	2
4. Writing Skill ------News Paper Report	2

UNIT-IV **9Hrs**

Short Story

From the text "Leela's Friend" by R.K.Narayan

1. Explanation of the text 3
2. Grammar----Phrasal Verbs, Wh- Questions 2
3. Vocabulary----Noun and Verb Suffixes 2
4. Writing Skill------Writing a Narrative 2

UNIT-V **9Hrs**

Inspiration

From the text "The Last Leaf" by O. Henry

1. Explanation of the text 3
2. Grammar----- Prepositions 2
3. Vocabulary-----Idioms 2
4. Writing Skill----- Precis Writing 2

INDIAN HERITAGE AND CULTURE

Credits : 2 **Semester: II**
Course Code: IC23201 **No. of Lecture Hours: 30**

Objectives:
- To apprise the students with a sound background of Indian Culture.
- To equip the students with social & community problems of India.
- To prepare the student for civil service exams where Indian Heritage & Culture paper is compulsory for all the streams.

Outcome:
CO1 : Student will have knowledge about Indian Customs and Traditions.
CO2: Student can make use of the subject knowledge to attempt all kinds of competitive especially civil services.
CO3 The Subject helps the student community to have knowledge of historical and contemporary social, religious and political issues of the nation.

6Hrs

UNIT I
INTRODUCTION-ANCIENT INDIAN HERITAGE AND CULTURE
1. Meaning of culture-Characteristics of Indian Culture
2. Indus Valley Civilization and Vedic/Aryan Culture
3. Mauryas and Guptas
4. Ashoka the great and Harshavardana
5. South Indian Kingdoms-Satavahanas, Pallavas, Cholas

6. Development of the art and architecture -contributions of Buddhism and Jainism

UNIT II

MEDIEVAL INDIA-INFLUENCE OF ISLAM ON INDIAN CULTURE 6Hrs

1. Cultural Development under the Delhi Sultanate and Mughals
2. Sufi and Bakti Movement in Medieval period
3. Cultural Achievements of Kakatiys and Qutubshahis
4. Development of Art and Architecture during medieval India.

UNIT III

IMPACT OF WEST AND REFORM MOVEMENTS **6Hrs**

1. Influence of Western culture on Indian Society,19th century Socio Religious Reform Movement-Raja Ram Mohan Roy, Ishwara Chandra Vidyasagar and Veerasalingam
2. Subaltern Movements in India- .Iyothirao Phiile-Savitribai Phiile,E.V Ramaswainy Naikar-Narayana Guru-Dr.B.R.Ambedkar
3. Indian National movement-Moderatc, Extremist and Gandhian phases

UNIT IV **6Hrs**

RELIGIONS AND COSTITUTIONAL INSTITUTIONS

1. Perceptions of all Major Religions-A critical analysis
2. Rise of communalism in Indian Society
3. Democratic system in India and its functions-Evolution of the constitution and organs of democracy.

UNIT-V **6Hrs**

SOCIAL GROUPS AND RIGHTS

1. Fundamental Rights,
2. Women, Children and LGBTQ
3. Tribal Culture- their Issues

REFERENCE BOOKS

1 .Jha, Dr K.N. 2006. Studies in ancient & Medieval India. COSMOS Book hive Ltd: Gurgaon.
2.Mahajan, V.D. 2008. Ancient India. S.Chand, New Delhi.
3.Manasseh, Dr P. 2010. An Overview of Indian Culture. Gamaleil Publishers, Hyderabad.
4.Malpani, Madanlal & Malpani, Shamsunder. 2014. Indian Heritage and Culture. Kalyani Publishers, Ludhiana.
5.Mhaske, Dr R.H. 2012. Human Rights, Social Justice and Political Challenges. Chandralok Prakashau, Kanpur.
6.Singh, Gurdip & Ahuja, V.K. 2012. Human Rights in 21" Century. Universal Law Publisher, New Delhi.

OPERATING SYSTEM

Credits : 4 **Semester : II**
Course Code: BS24203 **No. of Lecture Hours: 60**

Objective: To learn the core ideas in operating systems, process management, memory protection, CPU scheduling, concurrent programming, deadlocks and File systems.

Course Outcomes:
CO1: **Explain** functions, types and structures of operating system
CO2: **Analyze** various process management concepts including scheduling and synchronization
CO3: **Illustrate** the concepts of memory management and I/O system.
CO4: **Solve** issues related to file system interface.
CO5: **Choose** an appropriate Page replacement algorithm

UNIT – I 9Hrs

1. Introduction -Define Operating System, mainframe system, desktop systems 2
2. Multiprocessor systems, distributed systems, clustered systems 2
3. Real time systems , hand held systems 1
4. Operating system structures-system components 2
5. Operating system services, system calls 1
6. system programs, system structures , virtual machines 1

UNIT – II 9Hrs

1. Process concept-process concept, process scheduling 2
2. Operation on processes, cooperating processes 2
3. Inter process communication 2
4. Process scheduling-basic concepts, scheduling criteria, scheduling algorithms. 3

UNIT – III 9Hrs

1. Process synchronization-critical section problem 2
2. Semaphores, monitors 2
3. Deadlocks-deadlock characterization, methods for handling deadlocks 2
4. Deadlock prevention, Deadlock avoidance, Deadlock detection 3

UNIT – IV **9Hrs**

1. File system-file concept, access methods 2
2. Directory structure, file system mounting, file system sharing. 2
3. File system implementation-file system structure, file system implementation. 2
4. Directory implementation, allocation methods, free space management 3

UNIT – V **9Hrs**

1 Memory management-swapping, contiguous memory allocation 2
2 Fragmentation-internal and external fragmentation 2
3 Paging, segmentation, segmentation with paging. 3
4 Virtual memory management-demand paging 2
5. Page replacement algorithms, Thrashing and working set model.

ESSENTIAL READING

1. Silber Schatz Abraham, **Operating System Concepts**,2021,10th Edition
2. Silber Schatz Abraham, Galvin Peter, B. and Gagne Greg. 2006. **Operating System Concepts.** 6th Edition. India: Wiley.

SUGGESTED READING

1. Tanenbaum Andrew, S. 2001. **Modern Operating Systems.** New Delhi: Pearson Education

SERVER ADMINISTRATION

Credits:4 **Semester: II**
SubjectCode: BS24202 **No. of Lecture hours:60**

Objectives:

- To study the concepts of Windows Server OS

To learn the installation procedure of servers and different server services

Outcomes:

CO1: Choose different editions of operating system
CO2: Organize topologies in active directory
CO3: Compare different services in active directory
CO4: Compare networking services
CO5: Plan installation of required services in organization

UNIT – I 12Hrs

1. Introduction to Windows server 2012, windows server 2012 Editions & Features 2
2. Installation of Windows server 2012 OS , creating local user accounts 2
3. Networking : IP Addressing, Active Directory , Structure of Active Directory 3
4. Client and Member Server and User management 2
5. Permissions and types of permissions and User Profiles and home folders 3

UNIT -II **12Hrs**

1. Logical Structure of Active directory :Trees, Forest, Organizational Unit 3
2. Logical topologies (Work Group & Domain), ADC and Child Domain 2
3. Roles of Active directory and transfer and seizing of FSMO Roles 3
4. Group policy, Scope of Group Policy and Hierarchy of Group Policy 2
5. Delegating of Control, Software Deployment Policy and Folder Redirection 2

UNIT-III 12Hrs

1. Trust Relationships, Types of Trusts ,Domain and forest level Functions 3
2. Physical structure of Active directory , Global Catalog and RODC 3
3. Active directory domain services 3
4. Introduction to Rights Management Services, Federation Services 2
5. Overview of Light weight directory services 1

UNIT-IV 12Hrs

1. Introduction to Dynamic Host Configuration Protocol (DHCP) 2
2. Introduction to Domain Naming System (DNS) 2
3. Internet Information Services (IIS) – Web Server , HTTP,FTP Server 3
4. Routing, Working of Network Address Translation 2
5. Remote Access Services (RAS), Working Principle of VPN 3

UNIT-V 12Hrs

1. Network Access Protection, ICS and WSUS 3
2. Windows deployment services, Boot Images and Install Images 2
3. Disk Management: FAT, FAT 32, NTFS and Fault Tolerance 3
4. Backup and Recovery using Windows server backup2
5. Distributed File System and Groups 2

ESSENTIAL READING

1. William Panek **MCSA Windows Server 2012 R2 Complete Study Guide: Exams 70-410, 70-411, 70-412** 2nd Edition
2. Rand Morimoto,Michael Noel, Guy Yardeni, Omar Droubi, Andrew Abbate, ChrisAmaris **Windows Server 2012 Unleashed** 1st Edition

SUGGESTED READING

1. William Stanek. **Windows Server 2012 Pocket Consultant.** 1st Edition

DATA STRUCTURES WITH C

Credits : 4 **Semester : II**
Subject Code : BS24204 **No. of Lecture hours: 60**

Objective: To focus on different methods of sorting, searching, storing data and understanding time and storage efficiency.

Outcomes: Students will be able to
CO1: Choose appropriate data structures to represent data items in real world problems
CO2: Ilustrate non-linear data structures like linked list
CO3: Organize the data using sorting various linear data structures and determine time complexity
CO4: Construct data with nonlinear data structure using trees.
CO5: Explain the concept of graphs and b trees

UNIT I	**12hrs**
Introduction to Data Structures	1
Stacks- Definition and various operations performed on stacks	4
Queues - Definition and various operations performed on queues Stack applications	4
Notations - Prefix, Postfix, Infix	1
Conversions -Infix to Postfix, Infix to Prefix	2

UNIT II	**12hrs**
Data Representation, Concept of linked list	2
Advantages of Linked List, Types of linked list	1
Linear Linked list - Various operations performed on singly linked list	3
Doubly Linked List - Various operations performed on singly linked list	3
Circular Linked List	1
Applications of Linked Lists	2

UNIT III	**12hrs**
Trees	
Definition and properties	2
Binary Trees-Definition and Representation of Binary trees	2
Operations:insertion, deletion, search	2
Treetraversal techniques- in order. pre order. post order	2
AVLtrees	
Definition and representation of AVL	2
Trees	
OperationsonAVL trees- insertion, deletion	2

UNIT IV	**12hrs**
Sorting methods	1
Bubble sort	2
Insertion sort	2
Selection sort	2
Merge sort	2
Quick sort	2
Searching methods	1

UNIT - V	**12hrs**
Graphs	3
Terminology & Representations	
Definition and representation of graph	
Graph Traversal -BFS, DES	1
B-Trees	
Definition and representation of B-Trees	1
Operations on B- Tree-insertion, deletion, search	2
File Structures - Physical Storage Media File Organization	1
Sequential Files, Indexing and Hashing, Primary indices, Secondary indices	2
Indexing and Hashing Comparisons.	2

ESSENTIALREADING

Kanetkar, Yashvanth,2020, 14th Edition,Data Structures through C
1.:Kanetkar, Yashvanth.2008. Data Structures through C.India: BPB Publications.
2. Tanenbaum, A.M.Langsam, Y.Augenstein, M.J.Data Structures Using C. New Delhi: Pearson Education

SUGGESTED READINGS:

1.Balagurusamy, E. C Programming& Data Structures. Tata McGrawHill.
2.KrishnaMoorthy.R. IndiraniKumaravel, G. 2008.Data Structures Using C. Tata Mc Graw Hill Publishing Company Lid

MATRICES & VECTOR CALCULUS

Credits: 4 **Semester: II**
Subject Code: BS24201 **No of Lecture Hours: 75**

Objectives:

- The objective of this course is to present a user friendly introduction to Matrices and Vector Calculus and its many applications.

Outcome:

- Students will be able to develop specific skills, competencies and thought processes sufficient to support further study or work in this or related fields.

Course Outcomes:

CO1: Understand to find the rank of a matrix and to solve systems of linear equations applying matrix techniques.
CO2:Determine Eigenvalues and Eigenvectors of a given matrix and to apply these concepts to quadratic forms.
CO3: Differentiate and anti-differentiate a vector-valued function presented in symbolic form, **Find** the divergence and curl of a vector field
CO4: Use the gradient operator to calculate the directional derivative of a function
CO5: Understand the various integral theorems relating line, surface and volume integrals

UNIT I	**15 Hrs**
Systems of Linear Equations :	
Rank Of a Matrix	1
Rank - Echelon Form	3
Rank - Normal form	3
Solution of Linear Systems	
Homogeneous Equations, Non-Homogeneous Equations.	6
UNIT II	**15 Hrs**
Eigenvalues-Eigenvectors	
Eigenvalues-Eigenvectors–Properties	
Cayley-Hamilton Theorem(Without Proof)	5
Inverse and powers of a matrix by using Cayley-Hamilton theorem	5
Quadratic Forms-Reduction of Quadratic form to canonical form	5
UNIT III	
Vector Differentiation and ordinary derivatives of vectors	3
Continuity- Differentiability Gradient of a scalar field	3
Gradients, conservative fields and potentials	4
Applications of the gradient- Directional Derivative	5

UNIT-IV	**15Hrs**
Divergence of a Vector Point function - Properties	5

Curl of a Vector Point function - Properties	5
Problems on Divergence and Curl	5

UNIT V **15Hrs**

Vector Integration-	
Line Integrals-Surface integrals- Volume integrals	3
Green's Theorem(without proof)- Simple problems on Green's Theorem	4
Gauss's divergence theorem (without proof)- Simple problems on Gauss's theorem	4
Stoke's Theorem (without proof)- Simple problems related to Stoke's Theorem	4

ESSENTIAL READING

1. Matrices By AR.Vasishtha Krishna prakashan mandir ,Meerut.
2. P.C. Matthews, Vector Calculus
3. J.N. Sharma, A.R. Vasistha, 2013 **Vector Calculus**–Meerut: Krishna Prakashan, Mandir, for units (IV, V)

OPERATING SYSTEM LAB

Credits: 1 **Semester: II**
Subject Code:BS24206 **No. of Practical Hours: 30**

Objectives:

- To understand the commands and programming constructs of ShellProgramming.
- To understand various algorithms related to CPU scheduling and memory management.

Outcome: Students will be able to identify UNIX/Linux utilities and implement shell scripts to perform more complex tasks.

1.Introduction to Vi Editor, File and Directory related Commands.

1. Miscellaneous Commands

2. Arithmetic in ShellScripts

3. Sample programs using Shell Script

4. Decision making in ShellScript

5. Loop control structures in ShellScript.

6. Implementation of UNIX Systemcalls

7. Implementation of CPU Scheduling algorithms

9.Implementations of memory management algorithms

SERVER ADMINISTRATION LAB

Credits:1 **Semester:II**
SubjectCode: BS24205 **No. of Lecture hours:30**

Objective: To get hands on experience on installations, configurations of server serviceroles and troubleshooting procedures.
Outcome: Students will be able to implement, troubleshoot different server service roles in Windows server operating system

1. Installation of Windows server 2012 Operating system and Assigning IPAddress.
2.Installation of Active Directory in Windows server 2012, Installing ClientOS Windows 7/8.
3.Configuring Member server, Creating Domain User Accounts andChanging Default Password Policy

4.Creating Profiles and Configuring Home Folder

5.Configuring Additional Domain controller and child domain
.
6.Creating an Organizational Unit and Applying group policy on OU Level

7.Raising Functional Levels and creating Forest Trust

8. Configuring Terminal Server in Remote Administration Mode

9. Installing DHCP Service and Creating Scope and DHCP Reservations

10. Installation of DNS Service and Creating Forward Lookup zones andReverse Lookup zones

11. Installation of IIS Web server and Hosting a Website

12. Installation and Configuration of IIS FTP Server

13-14. Establishing Virtual Private Network IN windows server
15. Installation and Configuration

Data Structures with C Lab

Credits : 1 **Semester : II**
Subject Code : BS24207 **No. of Lecture hours:30**

Objectives: To implement data structures for problem solving To implement and analyze the searching algorithms in the context of specific engineering problems

Outcomes:

Choose the appropriate data structure for problem solving.
Code, debug and demonstrate the working nature of different types of data structures and their applications.
Analyze and Compare various linear and non-linear data structure.
Document the results and operations of various Data Structure.

1 Program to find transpose of a sparse matrix
2 Program to find the sum of two 2-D arrays of order 2X2
3 Program to find the transpose of a matrix
4 Program to find the upper triangle of an array
5 Program to find the trace of a 2-D array
6 Program to find the lower triangle of an aray
7 Program to find the addition of two sparse matrix
8 Program to perform linear search
9 Program to implement binary search
10Program to implement bubble sort
11 Program to implement insertion sort
12Program to implement selection sort
13 Program to implement quick sort
14 Program to implement merge sot on 2 sorted lists
15 Program to implement stack operations using aray
16 Program to implement queue operations using array
17 Program to implement stack operations using linked list
18 Program to implement queue operations using linked list
19 Program to convert infix expression to postfix
20 Program to evaluate a postfix expression
21 Program to create a linked list
22 Program to concatenate two lists
23 Programs to perform insertion and deletion operations on the linked list
24 Program to copy a list into another list
25 Program to split a list into two linked lists
26 Program to search for a node in the list.
27 Program to find the number of elements in the list
28 Program to illustrate tree traversal techniques.
29 Program to implement graph traversals