

**Meeting Proceedings of U.G. BOS in Computer Science and BCA**

As per the directions of the University, and in continuation of the previous meeting held on 12-01-2026, another meeting of the U.G. Board of Studies (BOS) in Computer Science and BCA was held on 12-02-2026 at the Office of the Department of MCA and Computer Science, Jnanasahyadri Campus, Kuvempu University, Shankaraghatta. The Chairman welcomed all the members to the meeting.

Further, based on the discussions held in the meeting conducted on 03-02-2026 in the presence of the Hon'ble Vice-Chancellor with UG BOS chairmans, regarding the revision of the SEP 2024-based curriculum framework for UG courses, the following agenda items were discussed and approved.

1. The Board prepared and approved the SEP-based syllabus content for the **Fifth and Sixth semesters** of the B.Sc. (Computer Science) and BCA programs.
2. In the B.Sc. (Computer Science) program, **two theory papers and one practical paper** in each of the Fifth and Sixth semesters are included. After thorough discussion, the Board resolved to approve the inclusion of a project work in the Sixth semester, in place of the practical paper.
3. The Board approved the modification of teaching hours from ~~03~~⁰⁴ **hours per week** to ~~04~~⁰³ **hours per week** for all Core Theory papers carrying **03 credits** in all six semesters of B.Sc. (Computer Science) and BCA programs. This change shall be effective from the academic year **2026-2027**.
4. The Board resolved to approve the inclusion of **Skill Enhancement Courses (three compulsory papers)**, one each in the Fourth, Fifth, and Sixth semesters of B.Sc. (Computer Science) and BCA programs, carrying **02 credits each** with **02 teaching hours per week**, amounting to a total of **06 credits**.

Finally, the meeting concluded with vote of thanks.

- 01 Dr. Prabhakar C.J.
Professor and Chairman,
Department of MCA and Computer Science,
Kuvempu University.
- 02 Dr. Shoieb Ahamed,
Assistant Professor,
Dept. of Computer Science,
Sir M. V Govt. Science College,
Bommanakatte, Bhadravathi.
- 03 Sri. Krishnamurthy K.
Assistant Professor, Dept. of Computer Science,
Govt. First Grade College, Thirthahalli.
- 04 Sri. Shashidhara B.
Associate Professor, Dept. of Computer Science,
I.D.S.G. Govt. College, Chikkamagalore.
- 05 Sri. Gopala B.
Assistant Professor, Dept. of Computer Science
Govt. First Grade College, Shikaripura.
- 06 Sri. Prajwal Kumar P
Assistant Professor, Dept. of Computer Science
Govt. First Grade College, Kadur.

Chairman

Prabhakar C.J.
12/02/2026

Member

Shoieb Ahamed
12/2/26

Member

Krishnamurthy K.
12/02/26

Member

Shashidhara B.

Member

Gopala B.

Member

Prajwal Kumar P.

Approved

Raja Naika
(DEAN)

Dr. RAJA NAIKA, M.Sc., M.Phil., Ph.D.
Senior Professor & Chairman
Department of P.G. Studies & Research in
Applied Botany, Kuvempu University,
Shankaraghatta-577451 Shivamogga (Dt.),
Karnataka, India.

Prabhakar C.J.

Chairman

B.O.S. (UG) in Computer Science & MCA
Department of MCA & Computer Science
Kuvempu University, Jnanasahyadri
Shankaraghatta-577451, Karnat.

**Meeting Proceedings of U.G. BOS in Computer Science and BCA**

The meeting of U.G.BOS in Computer Science and BCA was held on 12-01-2026 at 11.00 am in the Office of the Dept of MCA and Computer Science, Jnanasahyadri Campus, Kuvempu University Shankaraghatta. The chairman welcomed the members to the meeting and the members have discussed about the following agenda and approved the same.

Approval of SEP syllabus content for Fifth and Sixth semester of B.Sc. (CS) and BCA

The board has prepared the SEP based syllabus content for Fifth and Sixth semester of B.Sc. (Computer Science) and BCA programme and resolved to approve the prepared syllabus content of the said programmes.

Approval of the panel of examiners for B.Sc. (CS) and BCA for the year 2025-2026.

The Board scrutinized and updated the panel of examiners for the B.Sc. (Computer Science), and BCA programme for the academic year 2025-2026. The Board approved the updated panel of examiners and authorized the Chairman to forward the approved panel to the Registrar (Evaluation). Finally, the meeting concluded with vote of thanks.

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|----|---|----------|
| 01 | Dr. Prabhakar C.J.
Professor and Chairman,
Department of MCA and Computer Science,
Kuvempu University. | Chairman |
| 02 | Dr. Shoieb Ahamed,
Assistant Professor,
Dept. of Computer Science,
Sir M. V Govt. Science College,
Bommanakatte, Bhadravathi. | Member |
| 03 | Sri. Krishnamurthy K.
Assistant Professor, Dept. of Computer Science,
Govt. First Grade College, Thirthahalli. | Member |
| 04 | Sri. Shashidhara B.
Associate Professor, Dept. of Computer Science,
I.D.S.G. Govt. College, Chikkamagalore. | Member |
| 05 | Sri. Gopala B.
Assistant Professor, Dept. of Computer Science
Govt. First Grade College, Shikaripura. | Member |
| 06 | Sri. Prajwal Kumar P
Assistant Professor, Dept. of Computer Science
Govt. First Grade College, Kadur. | Member |

Prabhakar C.J.
12/01/2026

Shoieb Ahamed
12.1.26

Krishnamurthy K.
12/01/26

Shashidhara B.

Gopala B.
12/1/26

Prajwal Kumar P.
12/1/26

Approved

[Signature]

(DEAN)

Dr. P. K. A. M.Sc., M.Phil., Ph.D.
Senior Professor & Chairman
Department of P.G. Studies & Research in
Applied Botany, Kuvempu University,
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Prabhakar C.J.
Chairman

B.O.S. (UG) in Computer Science & MCA
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SEP – 2024

CURRICULUM STRUCTURE AND SYLLABUS

**Bachelor of Science (B.Sc) Programme
In
Computer Science**

[According to SEP (State Education Policy): 2024]

w.e.f Academic Year 2024-25

Under Graduate Board of Studies

In

**Computer Science and B.C.A.
Kuvempu University, Shankaraghatta,
Shimoga, Karnataka.**

Curriculum Design / Syllabus Framing Committee

Sl. No.	Name	Designation
1.	Dr. Prabhakar C J Professor, Department of P.G Studies and Research in Computer Science, Kuvempu University, Shankaraghatta – 577541, Shimoga.	Chairman
2.	Dr. Shoieb Ahamed Assistant Professor, Department of Computer Science, Sir M V Government Science College – 577301, Bommanakatte, Bhadravathi, Shimoga	Member
3.	Mr. Shashidhara B Associate Professor, Department of Computer Science, IDSG Government College, Chikkamagaluru – 577101,	Member
4.	Mr. Gopala B Assistant Professor, Department of Computer Science, Government First Grade College Shikaripura - 577427, Shimoga	Member
5.	Mr. Krishnamurthy K Assistant Professor, Department of Computer Science, Government First Grade College, Thirthahalli - 577432, Shimoga	Member
6.	Mr. Prajwal Kumar P Assistant Professor, Department of Computer Science, Government First Grade College, Kadur – 577548, Chikkamagaluru	Member

The objectives of the B.Sc (CS) Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This Programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem- solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

Program Outcomes

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems.
4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. **Application Systems Knowledge:** Possessing a minimum knowledge to practice existing computer application software.
6. **Communication:** Must have reasonably good communication knowledge both in oral and writing.
7. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
9. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Curriculum Structure for B.Sc. Computer Science
Programme with effect from 2025-26

SEP-2024

Case 1 : Three Majors with a General degree in all 6 Semesters

(Curriculum Framework for UG Programmes as suggested by KSHEC, Government of Karnataka (As per G.O. No.: ED 166 UNE 2023, Bengaluru, dated: 08-05-2024))

Semester-wise allocation of credits for B.Sc (CS) Programme

Year	Semester	Credits	Total Credits
1	I	05	10
	II	05	
2	III	07	16
	IV	09	
3	V	10	20
	VI	10	
Total		42	46

Curriculum Structure for B.Sc. in Computer Science for 2024-25

Case 1 : Three Majors with a General degree in all Six Semesters – Number of courses and credit course-wise in all semesters

Sem	Course/ Paper Code	Title of the Paper	Subject Category	Teaching Hour/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
1	2	3	4	5	6	7	8	9	10
Semester-I									
1	24BCS1	Computer Fundamentals and Programming in C	MC-T	04	80	20	100	03	3 Hrs.
	24BCS1P	Information Technology and C-Programming Lab	MC-P	04	40	10	50	02	3 Hrs.
	Total			08	120	30	150	05	---
Semester-II									
2	24BCS2	Data Structures Using C	MC-T	04	80	20	100	03	3 Hrs.
	24BCS2P	Data Structures Lab using C	MC-P	04	40	10	50	02	3 Hrs.
	Total			08	120	30	150	05	---
Semester-III									
3	24BCS3	Object Oriented Programming with Java	MC-T	04	80	20	100	03	3 Hrs.
	24BCS3P	JAVA Programming Lab	MC-P	04	40	10	50	02	3 Hrs.
	Elective I - Choose Any ONE								
	24BCSE31	Internet Basics	EL	02	40	10	50	02	2 Hrs.
	24BCSE32	E-Commerce	EL	02	40	10	50	02	2 Hrs.
	Total			10	160	40	200	07	---
Semester-IV									
4	24BCS4	Database Management Systems	MC-T	04	80	20	100	03	3 Hrs.
	24BCS4P	DBMS Lab	MC-P	04	40	10	50	02	3 Hrs.
	Elective II - Choose Any ONE								
	24BCSE41	Office Automation	EL	02	40	10	50	02	2 Hrs.
	24BCSE42	Cyber Security	EL	02	40	10	50	02	2 Hrs.
	Compulsory 1 (Practical knowledge/skill)								
	24BCS4C1	Digital Fluency	Compulsory 1	02	40	10	50	02	2 Hrs.
	Total			12	160	40	200	09	---
Semester-V									
	24BCS51	Operating System	MC-T	04	80	20	100	03	3 Hrs.
	24BCS52	Web Technologies	MC-T	04	80	20	100	03	3 Hrs.
	24BCS5P	Web Technologies Lab	MC-P	04	40	10	50	02	3 Hrs.
	Compulsory 2 (Practical knowledge/skill)								

	24BCS5C2	Python Programming	Compulsory 2	02	40	10	50	02	2 Hrs.
	Total			10	200	50	150	10	---
Semester-VI									
	24BCS61	Software Engineering	MC-T	04	80	20	100	03	3 Hrs.
	24BCS62	Computer Communication and Networks	MC-T	04	80	20	100	03	3 Hrs.
	24BCS6P	Project Lab	MC-P	04	40	10	50	02	3 Hrs.
	Compulsory 3 (Practical knowledge/skill)								
	24BCS6C3	Artificial Intelligence and Machine Learning	Compulsory 3	02	40	10	50	02	2 Hrs.
	Total			14	240	60	300	10	---
	Grand total			62	960	250	1450	46	---

Semester	Major Course (Paper) Major 1	Elective/ Optional	Compulsory
I	3+2 = 5	---	
II	3+2 = 5	---	
III	3+2 = 5	Elective 1- 2	
IV	3+2 = 5	Elective 2- 2	Compulsory 1 - 2
V	3+2+3 = 08	---	Compulsory 2 - 2
VI	3+2+3 = 08	---	Compulsory 3 - 2
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Total	36	04	06
Grand Total		46 Credits	

1. Credit for the three major courses includes theory, practical (skill enhancement course), and tutorial/assignment/survey-based assignment/internship.
2. Practical paper(s) (Compulsory/Skill enhancement course) should provide practical experience which is complimentary to theory major paper(s).

Theory - Continuous Assessment Programme/Internal Assessment

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Two Session Tests with proper record for assessment (5+5 = 10)	10
02	Assessment of Seminars/ Assignment with proper record	05
03	Attendance	05
TOTAL MARKS		20

Attendance Marks-breakup

<75% = **00 Marks**,

75-80% = **01 Mark**

, 80-85% = **02 Marks**

, 85-90% = **03 Marks**,

90-95%=**04 Marks**,

95% >=**05 Marks**

Practical Paper -Continuous Assessment Programme/Internal Assessment

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Attendance	05
02	Record/Journal	05
TOTAL MARKS		10

Practical Examination

Sl. No.	Component	Maximum Marks
Experimentation (Major & Minor/Spotters)	Writing Part-A +Part-B	10+10 =20 Marks
	Execution	10 Marks
Viva voice	Viva voice and Practical Record evaluation	10 Marks
	Total	40 Marks

Project Work - Continuous Assessment Programme/Internal Assessment

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Project work/Dissertation/Internship and preparation of Report	5
02	Viva Voice / Presentation	5
TOTAL MARKS		10

Project Work - Examination

Sl. No.	Component	Maximum Marks
01	Dissertation/ Report	30
02	Viva Voice/Presentation	10
TOTAL MARKS		40

B.Sc (CS) - I SEMESTER

Course Code: 24BCS1	Computer Fundamentals and Programming in C
Course Credits: 03	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 20
Exam Duration: 03 Hours	Summative Exam Marks: 80

Course Outcomes (COs):

- Introduction to computers, classification of computers, anatomy of computer, constituents and architecture.
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C

Content	Hours
Unit – 1	
Introduction to Computers - Computer Definition, Characteristics, History of Computers, Anatomy of Computer -Central Processing Unit, Storage units, Input and output Devices. Types of Computers, Types of Software - System Software and Utility Software; Operating System, Computer Languages – Machine Level, Assembly Level & High-Level Languages, Translators - Assembler, Interpreter and Compiler.	14
Unit – 2	
Number Systems - Binary, Octal, decimal hexadecimal, convert binary to decimal, Decimal to binary, Decimal to hexadecimal, hexadecimal to decimal. Binary 1's complement, binary 2's complement. Computer Codes-BCD, Gray Code, ASCII and Unicode; Basic logic gates and operations. Overview of C: History and Features of C, Structure of a C Program with Examples, C Character Set. Header files - stdio, conio, maths, string, ctype. C tokens - keywords, identifiers, constants, and variables; Data types-int, float, char, double, long. Declaration & initialization of variables; Symbolic constants.	14
Unit – 3	
Input and output with C-Formatted I/O functions - printf and scanf, control stings and escape sequences. Unformatted I/O functions - getchar, putchar, gets and puts. C Operators & Expressions - Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, Bitwise operators, Conditional operator, Operator Precedence and Associativity, Evaluation of arithmetic expressions.	12
Unit – 4	
Control Structures - Simple if, if_else, nested if_else, Switch-case, goto, break & continue statements; Looping Statements - while, do-while, for loops. Arrays - Definition, Declaration, Initialization, Types of arrays, Representation of Linear Arrays in memory, Two-dimensional array, Operations on Array. Pointers in C - Understanding pointers - Declaring and initialising pointers, accessing address and value of variables using pointers, Advantages and disadvantages of using pointers.	12

Text Books

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balagurusamy: Programming in ANSI C (TMH)

References

1. Kamathane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI – EEE)
3. S. Byron Gottfried: Programming with C (TMH)
4. Kernighan & Ritchie: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C
6. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: 24BCS1P	Information Technology (IT) and C Programming LAB
Course Credits: 02	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 10
Exam Duration: 03	Summative Exam Marks: 40

Practice Lab

The following activities be carried out/ discussed in the lab during the initial period of the semester.

1. Basic Computer Proficiency
 - a. Familiarization of Computer Hardware Parts
 - b. Basic Computer Operations and Maintenance.
 - c. Do's and Don'ts, Safety Guidelines in Computer Lab
2. Familiarization of Basic Software – Operating System, Word Processors, Internet Browsers, Integrated Development Environment (IDE) with Examples.

Part A:

- 1.Create Bio-data in word
- 2.Create timetable in word with text formatting
- 3.Create Content page with header and footer, including page number, date, title
- 4.Create PowerPoint Presentation with content animation
- 5.Create PowerPoint Presentation with Slide transition
- 6.Create student marks card in Excel
- 7.Create Bar Chart and Pie Chart in Excel for Stock market data
- 8.Create inventory Bill in Excel with formulas

Part B:

- 1.Write a C Program to swap two numbers
- 2.Write a C Program to check given number is odd or even
- 3.Write a C Program to Find Factorial of given number
- 4.Write a C Program to display Day of week using a switch case.
- 5.Write a C Program to generate N Fibonacci numbers using a for loop.
- 6.Write a C Program to read a number, find the sum of the digits
- 7.Write a C Program to read three numbers and find the biggest of three
- 8.Write a C Program to Reverse the given number using do-while loop
- 9.Write a C Program to read, store and display N numbers using Array

B.Sc (CS) - II SEMESTER

Course Code: 24BCS2	Data Structures using C
Course Credits: 03	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 20
Exam Duration: 03 Hours	Summative Exam Marks: 80

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting and searching

Course Content

Content	Hours
Unit – 1	
Introduction to data structures: Definition; Types of data structures - Primitive & Non- primitive, Linear and Non-linear; Operations on data structures. User Defined Functions - Need, Syntax. Recursive function - Definition, Examples - Fibonacci number, factorial of number, GCD, Towers of Hanoi; Comparison between iterative and recursive functions. Sorting – Selection sort, Bubble sort, Quick sort, Insertion sort, merge sort. Searching - Sequential Search, Binary search.	14
Unit – 2	
Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls. Queues: Basic Concepts – Definition and Representation of queues; Types of queues – Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues;	14
Unit – 3	
Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - malloc, calloc, realloc and free. Linked list: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, doubly linked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation.	12
Unit – 4	

Trees: Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; Binary tree: Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; preorder, inorder and postorder traversal;	12
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Text Books

1. Sartaj Sahani: Fundamentals of Data Structures

References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007))

Course Code: 24BCS2P	Data Structures Lab
Course Credits: 02	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 10
Exam Duration: 04	Summative Exam Marks: 40

Part A

1. write a C Program to read and transpose Matrix (two-dimensional array)
2. Write a C Program to Demonstrate Pointers Operations
3. Write a C Program to Demonstrate Dynamic memory allocation
4. Write a C Program to generate N Fibonacci numbers using a recursive function.
5. Write a C Program to find GCD using recursive function
6. Write a C Program to sort the given list using selection sort technique.
7. Write a C Program to sort the given list using Bubble sort technique

Part B:

1. Write a C Program to find element in Array using Binary search
2. Write a C Program to implement Stack.
3. Write a C Program to convert infix to postfix expression
4. Write a C Program to implement a simple queue.
5. Write a C Program to implement a Circular queue.
6. Write a C Program to implement a linear linked list.
7. Write a C Program to Create Binary search tree
8. Write a C Program to implement traversal of a binary tree.

B.Sc (CS) - III SEMESTER

Course Code: 24BCS3	Object Oriented Programming with Java
Course Credits: 03	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 20
Exam Duration: 03 Hours	Summative Exam Marks: 80

Contents	hours
Unit-1 : Object oriented concepts and paradigm, Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Arrays in java.String, Character,String Buffer. Objects and Classes: Basics of objects and classes in java, Constructors, destructor Visibility modifiers, Methods and objects and object lifecycle. this reference, I/O streams	14
Unit-2 : Inheritance - Inheritance in java, Super and subclass, Overriding, Object class, Polymorphism - Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class. Interfaces - Interfaces Vs Abstract classes, defining an interface, implementing interfaces ,extending interfaces.	12
Unit-3 Packages - Defining, creating and accessing a package, Understanding CLASSPATH, importing packages. Exception handling- Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally.	12
Unit-4 Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, GUI programming- Basic UI elements for labels, buttons, and text input/output - JFrame – main window container. JLabel, JButton, JTextField, JTextArea. Event and Event handling in java, Event types, Mouse and key events, Generic programming.	14

Reference Books:

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition,
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall
3. Object Oriented Programming with Java : Somashekara, M.T., Guru, D.S.,Manjunatha, K.S
4. Java 2 - The Complete Reference – Tata McGraw Hill publication.

Course Code: 24BCS3P	JAVA Programming Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
Part – A 1. Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading. 2. Program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. A main function should access the methods and perform the mathematical operations. 3. Program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values. 4. Program to create a student class with following attributes; Enrollment No: Name, Mark of sub1, Mark of sub2, mark of sub3, TotalMarks. The pass mark for each subject is 50. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of n student objects and display the details. 5. Create a Class Named College having data members Name of the class (BCA, BCom, BSc), Name of the staff, No of the students in the class, use constructors 6. Program to define a class called employee with the name and date of appointment. Create employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority. 7. Program to demonstrate interface in java program. 8. Program to Demonstrate exception handling in java. PART- B 1. Program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values. 2. Program which creates and displays a message on window 3. Program to draw several shapes in the created window 4. Program which creates a frame with two buttons: father and mother. When we click the father button the name of the father, his age and designation must appear. When we click mother, similar details of mother also appear. 5. Program to move any one shape according to the arrow key pressed. 6. Program to create a window when we press M or m the window displays Good Morning, A or a the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night. 7. Demonstrate the various mouse handling events using suitable examples. 8. Program to create menu bar and pull-down menus

B.Sc (CS) - IV SEMESTER

Course Code: 24BCS4	Database Management Systems
Course Credits: 03	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 20
Exam Duration: 03 Hours	Summative Exam Marks: 80

Contents	hours
Unit-1: Introduction to Database: Database system applications. Characteristics and Purpose of database approach. People associated with a Database system. Data models. Database schema. Database architecture. Data independence. Database languages, E-R Model: Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes. Relationships between the entities. Relationship types, structural constraints. Weak entity types, E -R diagram - examples.	14
Unit-2 : Relational Data Model: Relational model concepts. Characteristics of relations. Relational model constraints: Domain constraints, key constraints, integrity constraints. Relational Algebra: Basic Relational Algebra operations-union, intersection, selection, projection, cartesian product. JOIN operations. - inner, outer, Equi .	14
Unit-3 SQL and Data Normalization: SQL -DML, DDL, DCL, TCL Commands. Aggregate Functions and Grouping. Nested Sub Queries, Views. Normalization - Anomalies in relational database design. Functional dependencies. Normalization. Types of Normal forms- First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	12
Unit-4 Introduction to PL/SQL programming: Features and Advantages, PL/SQL Blocks - basic syntax, Variables and their scope, Constants, Literals, Data Types, Operators, Executable Statements. Conditional Control: IF Statements, CASE Statements, Iterative Control: Basic Loops -WHILE and FOR Loops, Reverse FOR LOOP Statement, Nested Loops, Labeling a PL/SQL Loop, exception handling.	12

References :

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson,
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6 th Edition, McGraw Hill,
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill,
6. Oracle Database 11G PL/SQL Programming

Course Code: 24BCS4P	DBMS Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART – A 1. Create a table Students with fields: StudentID (Primary Key) Name (VARCHAR)Age (INT)Grade (CHAR). Alter the Students table to add a new column Email (VARCHAR). Rename the Students table to display. 2. Create a table employee table(employee_id, employee_name, employee_dept salary), insert 5 records into the employee table. perform Update the salary on table referencing the key, example employee_id = XX. 3.Implementation of different types of constraints - PRIMARY KEY, FOREIGN KEY, UNIQUE, CHECK. 4. Create two table and demonstrate different types of Joins operations a) Inner Join b) Outer Join c) Natural Join 5.Create student table and Implement Aggregation Functions a) Group By & Having clause b) Order by clause PART- B 1.Write a simple anonymous PL/SQL block to display "Hello, PL/SQL World!". 2.Write a PL/SQL block to check if a number is positive, negative, or zero. 3.Write PL/SQL blocks to demonstrate NO_DATA_FOUND, TOO_MANY_ROWS, ZERO_DIVIDE, DUP_VAL_ON_INDEX 4.Create Simple Cursor: Write a PL/SQL block to retrieve and display the employee_id and employee_name for all employees from an employees table (assume it exists with these columns). display employee names with distinct salaries. 5.Create Simple Cursor: Write a PL/SQL block to retrieve and display the student table and Create a program to categorize students based on CGPA: 'A' for $CGPA \geq 9$, 'B' for $CGPA \geq 7$, 'C' for $CGPA \geq 4$, 'D' for others.

B.Sc (CS) - V SEMESTER

Course Code: 24BCS51	Operating System
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1: Introduction to Operating System: Definition, Early systems – Batch Systems, Multiprogramming, Time-Sharing, Real-time system, Handheld systems and Distributed systems. Open-Source Operating Systems. Process Management: Process Concept- Process Definition, Process State, Process Control Block, Process scheduling- Scheduling Queues, Schedulers, Context switch. Inter process communication (IPC).	14
Unit-2: CPU Scheduling – CPU - I/O burst cycle, CPU Scheduler, Preemptive scheduling, Dispatcher. Scheduling criteria, Scheduling Algorithms- First-Come-First-Served (FCFS), Shortest Job First (SJF), Priority Scheduling, Round Robin scheduling algorithms. Deadlocks - Definition with example, System Model, Deadlocks Characterization- – Necessary Conditions, Resource Allocation Graph, Methods for Handling Deadlocks -Deadlock Prevention, Deadlock Avoidance.	14
Unit-3: Memory Management - Logical and Physical Address Space, Swapping, Contiguous Allocation, Fragmentation, Paging, Segmentation. Virtual Memory: Definition, Demand Paging, Page Replacement Algorithms -First In First Out (FIFO), Optimal Page replacement. Thrashing.	12
Unit-4: File System - File Concepts, Attributes, Operations and Types of Files. File Access methods, Directory Structure, Protection and consistency semantics. File System Implementation- File System Structure, File Allocation Methods, Free Space Management. Disk Structure, Disk Scheduling- Definition, Algorithms- FCFS, SSTF, SCAN.	12

References :

1. Operating System Concepts, Silberschatz' et al., 10thEdition, Wiley, 2018.
2. Operating System Concepts - Engineering Handbook, Ghosh PK, 2019.
3. Understanding Operating Systems, McHoes A et al., 7th Edition, Cengage Learning,2014.
4. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson.
5. Operating Systems – A Concept Based Approach, Dhamdhare, 3rd Edition, McGrawHill Education India.
6. Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson

Course Code: 24BCS52	Web Technologies
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1: HTML Basics : HTML Document Structure, Text Formatting Tag, Headings, Horizontal Rule, Metadata , multi Media Tags – anchor, Table related Tags, Form-related Tags, HTML Attributes HTTP Methods: GET, POST, HTTP Status Codes, Introduction to CSS: Overview and features of CSS3. CSS Syntax, Selectors, Box Model.CSS Selectors and Specificity. Type of CSS.	14
Unit-2: CSS Animation: CSS Box Model: margin, border, padding, Box-sizing, Borders, Measurements. Positioning, CSS Grid Layout. Pseudo-classes: :hover, : active, :focus, : first-child, :last-child, :nth-child(), Keyframes Properties, Syntax, 2D Transforms Functions. CSS Transitions: CSS Transition Properties, Syntax, example. HTML5- SVG: Viewing SVG Files, Embedding SVG in, SVG Circle, SVG Rectangle, SVG Line	12
Unit-3: JavaScript: General syntactic characteristics, Primitives, operations, and expressions, Control Structures, Error Handling, user define function, Event handling. DOM Manipulation: Tree Structure, Selecting Elements- getElementById, querySelector. Object and Functions: document, window, console object Properties and Functions. Frameworks Introduction: Node.js & npm.	12
Unit-4: PHP overview: PHP syntax and variables, Control structures and functions, Forms handling, Database Connectivity: Introduction to DBMS, MySQL basics, , Database connectivity (PHP–MySQL), Prepared statements.	14

References:

1. **"Web Technologies: A Developer's Perspective"** by N. P. Gopalan and J. Akilandeswari (PHI Learning) - *Good for foundational web concepts.*
2. **"Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics"** by Jennifer Robbins (O'Reilly Media) - *Excellent for beginners, covering the basics comprehensively.*
3. **"HTTP: The Definitive Guide"** by Brian Totty, et al. (O'Reilly Media) - *For a more in-depth understanding of HTTP, though parts might be too advanced for Chapter 1*

Course Code: 24BCS52P	Web Technologies Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1. Develop and demonstrate a HTML document that illustrates a) Image as a background 2. Multimedia: - a) Develop a web page to play audio file using <a>Tag. b) Develop a web page to play video file using <Embed>Tag. 3. Develop and demonstrate a HTML document that illustrates a) the use of Formatting Text. b) Headings tags (H1, H2, H3, H4, H5, H6) c) Font Details (Font Size, Style, Type, Color) d) Setting Color (BG Color) 4. Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit. 5. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format. PART- B 1. Develop and demonstrate a HTML document that illustrates a) Unordered List (UL) b) Ordered List (OL) and Definition list (DL) c) Table Alignment (Cell Spacing, Cell Padding, Height, Width Border, Rowspan, colspan) d) Setting Different Table Attributes (Color, Image) 2. Create Style sheet to set formatting for text tags and embed that style sheet on web pages created for your site. 3. Design a timetable and display it in tabular format using html. 4. Design signup form to validate username, password, and phone numbers etc. using Java script 5. Write an HTML page that contains a selection box with a list of 5 countries .. Add CSS to customize the properties of the font of the capital (color, bold and font size). 6. Write a program for student registration form which contains: Name, Reg No, DOB, email id , Phone Number and Course using PHP and MySQL.

B.Sc (CS) - VI SEMESTER

Course Code: 24BCS61	Software Engineering
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Software Engineering, Software engineering ethics. Software process. Software process models: Waterfall Model, Incremental Model, Evolutionary Models. Agile software development: Principles of Agile, Requirements Engineering: Feasibility Study, Requirements Elicitation, Requirements Analysis, Requirements Specification, Requirements Management , Requirements Modeling: Use Case Diagrams, Sequence Diagrams,	13
Unit-2 : Software Design :Design Process and Quality Attributes (Maintainability, Reliability, Usability, Performance, Security,).Design Concepts: Abstraction, Architecture, Patterns, Modularity, Information Hiding, Functional Independence.Coupling and Cohesion. Architectural Design: Layered, Client-Server, Peer-to-Peer, Pipe-and-Filter, Microservices.	13
Unit-3 Component-Level Design: Class diagrams, interaction diagrams. Designing Components(concept, representation ,example): Flowcharts, pseudocode. User Interface Design (UI/UX Principles):Golden rules of interface design,User interface analysis and design process,Prototyping and evaluation.	10
Unit-4 Software Testing Fundamentals (concepts): Verification vs. Validation.Testing Principles.Testability.Test Plan, Test Case, Test Report. Testing Strategies: Unit Testing: White-box testing (basis path testing, control structure testing), black-box testing (equivalence partitioning, boundary value analysis). Integration Testing: Top-down, bottom-up, sandwich, regression testing. Validation Testing: Alpha, Beta testing, user acceptance testing.	12

References :

1. "**Software Engineering: A Practitioner's Approach**" by Roger S. Pressman and Bruce Maxim (McGraw-Hill Education) - *A classic and comprehensive guide for practitioners.*
2. "**Software Engineering**" by Ian Sommerville (Pearson Education) - *Covers a broad range of topics with a strong focus on fundamental concepts*

24BCS62: Computer Communication and Networks

Course: 25BCS62	Course Title: Computer Communication and Networks
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 20
Exam Duration: 3 Hours	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction: Computer Network-Types & Applications, Network Software Protocol Hierarchies, Network Topologies: Mesh, Star, Bus, Ring, Tree, Hybrid. Network Types: LAN, WAN, MAN, PAN. Network Models : OSI reference model, TCP/IP reference model, Comparison between OSI & TCP.	14
Unit-2 : Physical Layer : Data and Signals,Data Rate Limits, Transmission Media – Twisted pair, coaxial cable, optical fiber,radio transmission, microwave transmission and infrared transmission, switching – Circuit switching, Packet switching, Difference between Circuits witching & Packet switching.	14
Unit-3 Data Link Layer : Data Link Layer design issues, Error detection – Types of Errors,Single parity checking, Checksum, polynomial codes – CRC, Error correction- Hamming code, data link protocols- Unrestricted Simplex Protocol and Simplex Stop-and-Wait Protocol	12
Unit-4 Network Layer: Network layer design issues, Routing algorithms –Distance Vector Routing , Link State Routing (OSPF) , IPv4 Packet Format, Transport Layer : Transport Service primitives, UDP header &TCP segment header,Difference between TCP & UDP. Congestion & Congestion control algorithms – General Principles of Congestion control, Traffic Shaping-Leaky bucket algorithm, token bucket algorithm.	12

References :

1. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education, 2010.
- 2.Data Communication & Networking, Behrouza A Forouzan, 3rd Edition, Tata McGrawHill, 2001.
- 3.Data and Computer Communications, William Stallings, 10 th , Edition, PearsonEducation, 2017.
4. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI, 2012.
5. Data Communication & Network, Dr. Prasad, Wiley Dreamtech.
6. <http://higherred.mheducation.com/sites/0072967757/index.htmls>

Course Code: 24BCS6P	Project Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
Guidelines: - 1. The project is of 4 Hours per week for one (Semester VI) Semester duration. 2. The synopsis approval will be given by the project Guides. 3. Groups should be not more than five members. 4. The project labs will focus on survey, planning, designing, coding and testing of the project. Report: The project proposal should include the following: ● Title ● Introduction ● Literature survey ● Objectives ● Design Details of modules and process logic ● Development/Implementation stages ● Testing Report ● Results (Any Other Components as per project requirements can be added by Project guide.)

ELECTIVE I - BCA & B.Sc Cs III Semester

Course Code: 24BCAE31/ 24BCSE31	Internet Basics
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	Hours
Unit-1: Internet Basics: Basic concepts, communicating on the Internet, Internet, Difference between the Internet and the World Wide Web (WWW). Basic networking concepts (LAN, WAN) Web server, Web browser – understanding how a browser communicates with a web server, Client issues a request and sends a response, server terminates the connection.	8
Unit-2: Search Engines: What are search engines and how do they work? Popular search engines (Google, Bing, DuckDuckGo). Effective search strategies (keywords, advanced search operators). Evaluating search results for credibility. Internet Service Providers (ISPs) and types of connectivity (Dial-up, Broadband, Wi-Fi, Fiber, Mobile Data)	8
Unit-3: Web Addresses (URLs): Structure of a URL (Scheme, Domain, Subdomain, Subdirectory). Top-Level Domains. Domain Name Extension, establishing connectivity on the internet, IP Address – assigning IP Address static / dynamic. Internet Protocols: TCP/IP. HTTP/HTTPS, FTP, DNS.	8
Unit- 4: Network hardware: Network Interface Devices, Network Interface Cards (NIC), Wired vs Wireless NICs, MAC Address and ARP, Networking Devices-Hubs, Switches, and Bridges, Routers-Routing basics, static and dynamic routing. Access Points (AP) Firewalls (Hardware)	8

References:

1. "The Internet Book: Everything You Need to Know about Computer Networking and How the Internet Works" by Douglas E. Comer

ELECTIVE 2 - BCA & B.Sc Cs III Semester

Course Code: 24BCAE32/ 24BCSE32	E-Commerce
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	hours
Unit-1: E-Commerce and Online Shopping: E-commerce structure, Popular online shopping websites, Safe online shopping practices. Distinction between E-commerce and E-business. Benefits and limitations of E-commerce. E-commerce Business Models: Business-to-Consumer (B2C), Business-to-Business (B2B), Consumer-to-Consumer(C2C), Consumer-to-Business (C2B), Government-to-Citizen (G2C), Government-to-Business (G2B), etc., Emerging models.	8
Unit-2: E-commerce Platforms and Solutions: Types of e-commerce platforms (SaaS, open-source, custom-built). Popular platforms (Shopify, WooCommerce, Magento, BigCommerce). Features and considerations for choosing a platform Building an E-Commerce Website, Building an E-commerce Presence: Website design principles for e-commerce (UX/UI, mobile responsiveness). Content Management Systems (CMS) in e-commerce.	8
Unit-3: Digital Marketing Strategies: Search Engine Optimization (SEO) for e-commerce. Search Engine Marketing (SEM) - Paid advertising (Google Ads). Social Media Marketing (SMM) and social commerce. Email Marketing and customer relationship management (CRM). Content Marketing for e-commerce. Affiliate Marketing.	8
Unit-4: E-Commerce Security: Common security threats (phishing, malware, DDoS attacks, data breaches). Security measures (SSL/TLS, firewalls, encryption). Digital certificates and authentication. Anti-virus, and Anti-malware, Data Protection and Privacy Intellectual Property Rights (IPR) .	8

References:

1. Kenneth C. Laudon, Carol Guercio Traver - E-Commerce, Pearson, 10th Edition, 2016
2. Laudon, K. C., & Traver, C. G. (Latest Edition). *E-commerce: Business. Technology. Society*. Pearson.

ELECTIVE I – BSc Cs IV Semester

Course Code: 24BCSE41	Office Automation
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02 hours	Semester end Exam Marks: 40

Contents	hours
Unit-1: Windows Desktop - GUI: Definition, Standards, Cursors/Pointers, Icons, GUI Menus, GUI-Share Data – Desktop icons and their functions: My computer, My documents, Network neighbourhood, Recycle Bin, Quick launch tool bar, System tray, Start menu, Task bar – Dialog Boxes: List Box, Spin Control Box, Slide, Drop-down list, Radio button, Check box, Text box, Task Bar - System Tray - Quick launch tool bar - Start button - Parts of Windows -Title bar-Menu bar - Scroll bar- Status bar, Maximize, Minimize, close and Resize & Moving a Window – Windows - Start Menu –Help Menu- Preview Menu; Logoff & Shutdown – Keyboard Accelerators: Key board short keys	8
Unit-2: MS Word Working with Documents -Opening & Saving files, Editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins, Converting files to different formats, Importing & Exporting documents, Sending files to others, Using Tool bars, Ruler, Using Icons, using help, Formatting Documents - Setting Font styles, Font selection- style, size, colour etc, Type face - Bold, Italic, Underline, Case settings, Highlighting, Special symbols, Setting Paragraph style, Alignments, Indents, Line Space, Margins, Bullets & Numbering. Setting Page style - Formatting Page, Page tab, Margins, Layout settings, Paper tray, Border & Shading, Columns, Header & footer.	8
Unit-3: MS Excel Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Using help, Shortcuts, Spreadsheet types. Working with Spreadsheets- opening, saving files, setting Margins. Spread sheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. Entering & Deleting Data- Entering data, Cut, Copy, Paste, Undo, Redo, Filling Continuous rows, columns, highlighting values, Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols, Clipart, Pictures,	8
Unit-4: MS Power Point Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, Selecting presentation layouts. Creating a presentation - Setting Presentation style, Adding text to the Presentation. Formatting a Presentation - Adding style, Colour, gradient fills, arranging objects, Adding Header & Footer, Slide Background, Slide layout. Adding Graphics to the Presentation- Inserting pictures, movies, tables etc into presentation, Drawing Pictures using Draw. Adding Effects to the Presentation- Setting Animation & transition effect. Printing Handouts	8

References:

1. Computer Concepts and Programming, Padma Reddy
2. Let us C , Yashwanth Kanetkar
3. Ansi C, Balagurusamy
4. Problem Solving with C, M. T. Somashekara and D. S. Guru

ELECTIVE II – BSc Cs IV Semester

Course Code: 24BCSE42	Cyber Security
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02 hours	Semester end Exam Marks: 40

Contents	hours
Unit-1: Introduction to Cyber Security Definition, Importance of Cyber Security, Common Cyber Threats and Attacks, Viruses, Worms, Trojans, Phishing, Ransomware, Spyware, Social Engineering Attacks, CIA Triad: Confidentiality, Integrity, Availability. Cyber Ethics and Safe Browsing Practices. Regulation of Cyberspace, Issues and challenges of cyber security.	8
Unit-2: Cyber Laws, Safety & Awareness Overview of Cyber Laws in India (IT Act 2000). Types of Cyber Crimes- Identity Theft, Online Fraud, Cyber Bullying. Reporting Cyber Incidents (CERT-IN, Cyber Crime Portal) Cyber Hygiene: Updating software, backups, antivirus. Creating a Safe Digital Environment (for self, home, institution)	8
Unit-3: Basics of Cryptography: Symmetric and Asymmetric Encryption. Algorithms concept: DES, AES, RSA, ECC. Hash Functions: MD5, SHA Family. Digital Signatures and Certificates. Public Key Infrastructure (PKI). Authentication Mechanisms: Passwords, OTP, Biometric, Multi-Factor Authentication	8
Unit – 4: Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hash tag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media.	8

Reference:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra.
- 2 Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011).
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.

FOURTH SEMESTER – COMPULSORY 1

24BCS4C1: Digital Fluency

Course Code: 24BCS4C1	Course Title: Digital Fluency
Course Credits: 02	Hours/Week: Theory -01 hour + 02 hours practical demonstration in classroom
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02 hours	Semester end Exam Marks: 40

Course Objectives

This course aims to:

- Develop confidence in the effective use of digital technologies
- Enhance information, media, and data literacy skills
- Promote safe, ethical, and responsible digital practices
- Enable collaboration and communication using digital platforms
- Create awareness of emerging digital technologies and careers

Content	Hours
Unit - I	
Concept of digital fluency vs digital literacy, Evolution of digital technologies, Overview of computer systems- Hardware components and Software types (system and application software), Operating systems and file management, examples of operating systems: MS-DOS, Windows, Mac OS, Linux, Solaris, Android. Digital devices: smartphones, tablets, IoT devices, Basics of the Internet and web technologies, Internet of Things (IoT) overview, Cloud computing concepts, Digital payments technologies, E-governance and Digital India initiatives	8
Unit - II	
Introduction to Computer Networks: Evolution of Networking, types of networks, Network devices - Modem, ethernet card, RJ45, Repeater, Hub, Switch, Router, and Gateways, Identification of Nodes in a Networked Communication, Internet, Web and the Internet of Things, Domain Name Systems. Security Aspects - Threats and Prevention, Malware - virus, Worms, Ransomware, Trojan, spyware, adware, key loggers, Modes of Malware distribution, Antivirus, Firewall, Cookies, Hackers and Crackers	8
Unit - III	
Introduction to e-learning platforms such as Swayam, and MOOC. Virtual Meet:	

Technical Requirements, Scheduling a meeting, joining virtual meet, recording the meeting, Online Forms: Creating questionnaire, Publishing Questionnaire, conducting online responses, Analysing the responses, copying graphics into PowerPoint, Downloading the response to spreadsheet. Introduction to societal impacts, Digital Foot prints, Digital Society and Netizen, Data Protection, E-waste, Impact on Health.	4
Unit - III Identifying the configuration of a computer system, laptop, and a mobile phone, Identifying the version and the configuration of the operating system of a computer, laptop, and a mobile phone, Identifying the network components like patch cord, switch, RJ 45 Jack, Socket, and wireless router, creating a hotspot from a mobile phone, and allowing others to use the hotspot, creating a Google form, and send it to five users, scheduling a Google meet and invite three people to join the Google meet, record the Google Meet, creating a one minute video of your choice in your native tongue, and upload the video to YouTube.	12

Web Resources:

1. Operating Systems - https://ftms.edu.my/v2/wp-content/uploads/2019/02/csca0101_ch06.pdf
2. Database Concepts - <https://ncert.nic.in/textbook/pdf/keip107.pdf>
3. Computer Networks - <https://ncert.nic.in/textbook/pdf/lecs110.pdf>
4. Security Aspects - <https://ncert.nic.in/textbook/pdf/lecs112.pdf>
5. Offences and Penalties Under IT Act 2000 - <https://taxguru.in/corporate-law/offences-penaltiesinformation-technology-act-2000.html>
6. Societal Impact - <https://ncert.nic.in/textbook/pdf/leip106.pdf>
7. Google Meet Tutorial - <https://edvance.hawaii.hawaii.edu/wp-content/uploads/Google-Meet-Tutorial-Getting-Started-and-Recording-a-Lecture.pdf>
8. [Tutorial-Getting-Started-and-Recording-a-Lecture.pdf](https://edvance.hawaii.hawaii.edu/wp-content/uploads/Google-Meet-Tutorial-Getting-Started-and-Recording-a-Lecture.pdf)
9. Google Forms - https://pdst.ie/sites/default/files/Google%20Drive_1.pdf

FIFTH SEMESTER – COMPULSORY 2

24BCS5C2: Python Programming

Course Code: 24BCS5C2	Course Title: Python Programming
Course Credits: 02	Hours/Week: Theory -01 hour + 02 hours practical demonstration in classroom
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02 hours	Semester end Exam Marks: 40

Course Learning Objectives:

- To teach the basic of Python programming concepts like what Python is and its key characteristics.
- Describe the history and evolution of Python.
- Identify the various applications of Python in real-world scenarios.
- Understand the importance of decision-making and control flow in programming.
- Understand the concept and usage of arrays and Functions in Python.

Unit-1

8 Hrs.

Introduction to Python: What is python, Characteristics of python, Application of python, History of Python, Python feature, and Environment set up, Python syntax, Python comment, Python variable, Python data types, Python string, Python list, Python tuples, Python sets, Python dictionaries.

Unit-2

8 Hrs.

Python Decision making and looping: Python condition, if statements, elif, else, Shorthand if, Shorthand if else, and, or, Nested if, pass statement, Python while loop, for loop, Looping through a string, else in for loop, Loop control statements.

Unit-3

8 Hrs.

Python Arrays: What is an array, Access the element of an array, Length of an array, looping array element, adding array elements, Removing array elements and array methods. Python Function: Creating a function, calling a function, Default parameter values, passing a list as a parameter, Return values, Arbitrary arguments, Function arguments, Anonymous function, Built in function.

Unit-4

8 Hrs.

Introduction to Python libraries: NumPy (arrays and operations), Pandas (data frames and analysis), Overview of Python applications (Web, AI, Automation). Web Development with Python: Introduction to Flask, Basic Concept of Flask, Template and Static files in Flask, Form Handling. Introduction to Django, Basic concept of Django, Views in Django.

References:

1. Chun, J Wesley, Core Python Programming, Second Edition, Pearson, 2010
2. Barry, Paul, Head First Python, 2nd Edition, O Reilly, 2010.
3. Lutz, Mark, Learning Python, 4th Edition, O Reilly, 2009.

SIXTH SEMESTER – COMPULSORY 3
24BCS6C3: Artificial Intelligence and Machine Learning

Course Code: 24BCS6C3	Course Title: Artificial Intelligence and Machine Learning
Course Credits: 02	Hours/Week: Theory -01 hour + 02 hours practical demonstration in classroom
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02 hours	Semester end Exam Marks: 40

Course Objectives

1. To understand fundamentals of modern web technologies
2. To design and develop dynamic web applications
3. To introduce core Artificial Intelligence concepts
4. To integrate AI techniques into web-based applications

Content	Hours
Unit - I	
Introduction to AI: Overview of Artificial Intelligence, Types of Artificial Intelligence, Types of AI Based on Functionalities. Agents in AI, Architecture of AI Agents, AI Agent Classification, Types of Agents, Use Cases of AI Agents, Benefits of AI Agents, Limitations.	8
Unit – II	
Machine Learning Skills: Machine learning workflow, Machine Learning: Supervised / Unsupervised learning, Feature engineering, Model building, Model evaluation, Python libraries: NumPy, Pandas, Scikit-learn, Deep Learning: Neural networks, CNNs, RNNs, Frameworks: TensorFlow / Keras, PyTorch	8
Unit – III	
AI + Web Integration : (real products). Integrating ML models with web applications, Model serving techniques using APIs. Deploy ML models as REST APIs: Flask/FastAPI , Model inference optimization, AI chatbots & recommender systems	8
Unit – IV : Project Ideas (Web + AI):	
AI-powered LMS / ERP, Resume screening system, Chatbot for university admissions, Medical image analysis web app, Recommendation system (courses / movies), Fake news detection portal	8

References

1. Russell, S., & Norvig, P, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education, 2021.
2. Géron, A. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 3rd Edition, O'Reilly Media, 2022.
3. Grinberg, M. *Flask Web Development: Developing Web Applications with Python*, 2nd Edition, O'Reilly Media, 2018.
4. Duckett, J. *HTML and CSS: Design and Build Websites*, Wiley, 2011.
5. Crockford, D. *JavaScript: The Good Parts*, O'Reilly Media, 2008.

THEORY EXAMINATION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS
(Semesters I –VI)

B.Sc. (CS) Semester-I Degree Examination; 2024-25
(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: COMPUTER SCIENCE

Paper – ____: _____

Paper Code: _____

Time: 3 Hours

Max.

Marks: 80

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

1. Answer all the following questions:

(2×10=20)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

SECTION-B

Answer any SIX of the following: (Two Questions From each Unit)

(5×6=30)

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

SECTION -C

Answer Any Three of the following:

(10×3=30)

- 10.
- 11.
- 12.
- 13.

From Unit-I

From Unit-II

From Unit-III

From Unit-IV

THEORY EXAMINATION QUESTION PAPER PATTERN FOR ELECTIVE/OPTIONAL PAPERS

(Semesters III & IV)

B.Sc. Semester-I/II/III/IV/V Degree Examination; 2024-25
(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: COMPUTER SCIENCE

Paper – ELECTIVE/OPTIONAL III & IV ____: _____

Paper Code: _____

Time: 2 Hours

Max. Marks: 40

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

Answer **all** the following questions:

(2×5=10)

- 1.
- 2.
- 3.
- 4.
- 5.

SECTION-B

Answer any **SIX** of the following:

(5×6=30)

- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

Syllabus Distribution for Question Paper Setting

Section-A	Ten Questions of each carrying 02 marks	Two questions each from unit-1 and Unit-2. And Three questions each from Unit-3 and unit-4.
Section -B	Eight Questions carrying 06 marks each.	Two questions from each unit.
Section -C	Four Questions carrying 10 marks each	One question from each unit. (There shall be sub-Questions.)

KUVEMPU



UNIVERSITY

SEP – 2024

CURRICULUM STRUCTURE AND SYLLABUS

**Bachelor of Computer Applications (BCA)
Programme**

[According to SEP (State Education Policy): 2024]

w.e.f Academic Year 2024-25

Under Graduate Board of Studies

In

Computer Science and B.C.A.

Kuvempu University, Shankaraghatta,

Shimoga, Karnataka.

Curriculum Design / Syllabus Framing Committee

Sl. No.	Name	Designation
1.	Dr. Prabhakar C J Professor, Department of P.G Studies and Research in Computer Science, Kuvempu University, Shankaraghatta – 577541, Shimoga(D).	Chairman
2.	Dr. Shoieb Ahamed Assistant Professor, Department of Computer Science, Sir M V Government Science College – 577301, Bommanakatte, Bhadravathi, Shimoga(D).	Member
3.	Mr. Shashidhara B Associate Professor, Department of Computer Science, IDSG Government College, Chikkamagaluru(D) – 577101,	Member
4.	Mr. Gopala B Assistant Professor, Department of Computer Science, Government First Grade College Shikaripura - 577427, Shimoga(D).	Member
5.	Mr. Krishnamurthy K Assistant Professor, Department of Computer Science, Government First Grade College, Thirthahalli - 577432, Shimoga(D).	Member
6.	Mr. Prajwal Kumar P Assistant Professor, Department of Computer Science, Government First Grade College, Kadur – 577548, Chikkamagaluru(D).	Member

The objectives of the BCA Programme

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise software.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This Programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem- solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

Program Outcomes

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems.
4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. **Application Systems Knowledge:** Possessing a minimum knowledge to practice existing computer application software.
6. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
7. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
9. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Bachelor of Computer Applications -Semester Scheme
Curriculum Structure for Bachelor of Computer Applications for 2024-25
as per SEP-2024

Case - 3: Single Subject Specialization from the First Semester
(Course Structure, Scheme of Teaching and Evaluation - 2024-25)

Curriculum Framework for UG Programmes as suggested by KSHEC,
Government of Karnataka

(As per G.O. No.: ED 166 UNE 2023, Bengaluru, dated: 08-05-2024)

Semester-wise allocation of credits for BCA Programme

Year	Semester	Credits	Total Credits
1	I	15	30
	II	15	
2	III	17	36
	IV	19	
3	V	20	40
	VI	20	
Total			106

BCA Programme - Course Structure and Scheme of Evaluation - 2024-25

Sem.	Course/ Paper Code	Title of the Paper	Subject Category	Teaching Hour/week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
1	2	3	4	5	6	7	8	9	10
Semester-I									
1	24BCA11	Fundamentals of Computers	BC-T	04	80	20	100	04	3 Hrs.
	24BCA12	Programming in C	BC-T	04	80	20	100	04	3 Hrs.
	24BCA13	Mathematical Foundation	BC-T	04	80	20	100	03	3 Hrs.
	24BCA11P	C programming LAB	BC-P	04	40	10	50	02	3 Hrs.
	24BCA12P	Information Technology LAB	BC-P	04	40	10	50	02	3 Hrs.
	Total			20	320	80	400	15	---
Semester-II									
2	24BCA21	Data Structures Using C	BC-T	04	80	20	100	04	3 Hrs.
	24BCA22	Java Programming	BC-T	04	80	20	100	04	3 Hrs.
	24BCA23	Operating System	BC-T	04	80	20	100	03	3 Hrs.
	24BCA21P	Data Structures Lab using C	BC-P	04	40	10	50	02	3 Hrs.
	24BCA22P	Java Programming LAB	BC-P	04	40	10	50	02	3 Hrs.
	Total			20	320	80	400	15	---
Semester-III									
3	24BCA31	Database Management System	BC-T	04	80	20	100	04	3 Hrs.
	24BCA32	Design and Analysis of Algorithms	BC-T	04	80	20	100	04	3 Hrs.
	24BCA33	Computer Communication and Networks	BC-T	04	80	20	100	03	3 Hrs.
	24BCA31P	DBMS Lab	BC-P	04	40	10	50	02	3 Hrs.
	24BCA32P	ADA Lab	BC-P	04	40	10	50	02	3 Hrs.
	Elective I - Choose Any ONE								
	24BCAOE31	Internet Basics	EL	02	40	10	50	02	2 Hrs.
	24BCAOE32	E-Commerce	EL	02	40	10	50	02	2 Hrs.
	Total			22	360	90	450	17	---
Semester-IV									
4	24BCA41	Python Programming	BC-T	04	80	20	100	04	3 Hrs.
	24BCA42	Web Technologies	BC-T	04	80	20	100	04	3 Hrs.
	24BCA43	Software Engineering	BC-T	04	80	20	100	03	3 Hrs.
	24BCA41P	Python Lab	BC-P	04	40	10	50	02	3 Hrs.
	24BCA42P	Web Technologies Lab	BC-P	04	40	10	50	02	3 Hrs.
	Elective II - Choose Any ONE								
	24BCAOE41	Software Testing	EL	02	40	10	50	02	2 Hrs.

	24BCAOE42	Digital Image Processing	EL	02	40	10	50	02	2 Hrs.
	Compulsory 1 (Practical knowledge/skill)								
	24BCA4C1	Blockchain Technology	Compulsory 1	02	40	10	50	02	2 Hrs.
	Total			24	400	100	500	19	---
	Semester-V								
5	24BCA51	PHP and MY SQL	BC-T	04	80	20	100	04	3 Hrs.
	24BCA52	Artificial Intelligence and Machine Learning	BC-T	04	80	20	100	04	3 Hrs.
	24BCA53	Cyber Security	BC-T	04	80	20	100	03	3 Hrs.
	24BCA51P	PHP LAB	BC-P	04	40	10	50	02	3 Hrs.
	24BCA52P	AI and ML Lab	BC-P	04	40	10	50	02	3 Hrs.
	Discipline Elective I- Choose Any ONE								
	24BCADE51	Data Mining and Data Warehouse	EL	04	80	20	100	03	3 Hrs.
	24BCADE52	Unix Operating System	EL	04	80	20	100	03	3 Hrs.
	Compulsory 2 (Practical knowledge / skill including interaction with industry/Internship)								
	24BCA5C2	MOOCs / Industry Internship	Compulsory 2	02	40	10	50	02	2 Hrs.
	Total			26	440	110	550	20	---
	Semester-VI								
6	24BCA61	Full Stack Development	BC-T	04	80	20	100	04	3 Hrs.
	24BCA62	Cloud Computing	BC-T	04	80	20	100	04	3 Hrs.
	24BCA63	Big Data Analysis	BC-T	04	80	20	100	03	3 Hrs.
	24BCA61P	Full Stack Development Lab	BC-P	04	40	10	50	02	3 Hrs.
	24BCA62P	Project Lab	BC-P	04	40	10	50	02	3 Hrs.
	Discipline Elective II- Choose Any ONE								
	24BCADE61	Internet of Things	EL	04	80	20	100	03	3 Hrs.
	24BCADE62	Business Intelligence	EL	04	80	20	100	03	3 Hrs.
	Compulsory 3								
	24BCA6C3	Mobile Application Development	Compulsory 3	02	40	10	50	02	3 Hrs.
	Total			26	440	110	550	20	---
	Grand total			138	2280	570	2850	106	---

Scheme of Evaluation

Curriculum Structure for Undergraduate Programme for 2024-25

Case 3 : Single Subject Specialization from the Ist Semester

Number of courses and credit course-wise in all semesters

Semester	Major Course (Papers) Major Credits	Elective/ Optional	Compulsory
I	15	---	
II	15	---	
III	15	Open Elective 1= 2	
IV	15	Open Elective 2= 2	Compulsory 1 = 2
V	15	Discipline Elective 1= 3	Compulsory 2 = 2
VI	15	Discipline Elective 2= 3	Compulsory 3 = 2
Total	90	10	06
	Grand Total	106 Credits	

Theory - Continuous Assessment Programme/Internal Assessment

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Two Session Tests with proper record for assessment (5+5 = 10)	10
02	Assessment of Seminars/ Assignment with proper record	05
03	Attendance	05
TOTAL MARKS		20

- **Attendance Marks-breakup**

<75% = **00 Marks**,

75-80% = **01 Mark**

, 80-85% = **02 Marks**

, 85-90% = **03 Marks**,

90-95%=**04 Marks**,

95% >=**05 Marks**

Practical Paper -Continuous Assessment Programme/Internal Assessment

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Attendance	05
02	Record/Journal	05
TOTAL MARKS		10

Practical Examination

Sl. No.	Component	Maximum Marks
Experimentation (Major & Minor/Spotters)	Writing Part-A +Part-B	10+10 =20 Marks
	Execution	10 Marks
Viva voice	Viva voice and practical record evaluation	10 Marks
	Total	40 Marks

MOOCs / Industry Internship during V Semester

The students shall take up MOOCs in Computer Science (SWAYAM / NPTEL / Coursera / edX, etc.) or Industry Internship with minimum of eight weeks during fifth semester. The students shall initiate to choose either MOOCs or Industry Internship after the fourth semester examination (semester break). The students have to contact the allotted guide while selecting the MOOCs course/while selecting the organization for Internship. In the end of fifth semester, the students have to submit the report with the consent from the allotted guide for external evaluation.

Project/Industry Internship/MOOCs - Examination

Sl. No.	Component	Maximum Marks
01	Certificate/Dissertation/ Report	30
02	Viva Voice/Presentation	10
TOTAL MARKS		40

Project/Industry Internship/MOOCs - Continuous Assessment

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Project work/Dissertation/Internship and preparation of Report	5
02	Viva Voice / Presentation	5
TOTAL MARKS		10

I SEMESTER

Course Code: 24BCA11	Fundamentals of Computers
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Computers - Computer Definition, Characteristics, History of Computers, Anatomy of Computer -Central Processing Unit, Storage units, Input and output Devices. Types of Computers, Types of Software - System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translators - Assembler, Interpreter and Compiler.	12
Unit-2 : Number Systems - Binary, Octal, decimal hexadecimal, convert binary to decimal, Decimal to binary, Decimal to hexadecimal, hexadecimal to decimal. Binary 1's complement, binary 2's complement. Computer Codes-BCD, Gray Code, ASCII and Unicode. Basic logic gates and operations.	12
Unit-3 Operating Systems - Introduction, Functions of an Operating System, Type of Operating Systems. The User Interface, Using Mouse, Icons, File explorer ,Toolbar, Status Bar, Menu bar , Operations on File and Directories. Computer networks- LAN, WAN; Concept of Internet, www, search engines,IP address Applications of Internet.	14
Unit-4 Word Processing - Word Processing GUI, Opening and Closing of documents, Text creation and Formatting, Table handling, Page setup. Presentation - GUI, creating slides, text/content animation, slide transition. Slide show. Spreadsheet: Structure of Spreadsheet, Manipulation of cells;, Formulas and Functions-sum,avg,min,max,if.charts- bar,pie,line.	14

References

1. Computer Fundamentals, V Rajaraman.
2. Computer System Architecture (3rd edition) Morris Mano PHI.
3. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition)
4. Link : Word - ppt - sheet. <https://support.microsoft.com/en-us/office/>

Course Code: 24BCA12	Programming in C
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Problem solving with a Computer - Algorithm and Flowchart- Notations ,Examples- Area of a circle, find largest of 3 numbers ,sum N number. Overview of C - History and Features of C, Structure of a C Program, Creating and Executing a C Program. C Character Set, C tokens - keywords, identifiers, constants, and variables. Data types - Declaration & initialization of variables, Symbolic constants. Header files - stdio, conio, maths, string, ctype.	14
Unit-2 : Input and output with C: Formatted I/O functions - printf and scanf, control stings and escape sequences. Unformatted I/O functions - getchar, putchar, gets and puts functions. Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, Bitwise operators, Conditional operator, Special operators, Operator Precedence and Associativity, Evaluation of arithmetic expressions. Control Structures - if, if_else, Switch Case, goto, break & continue statements. Looping Statements - while, do-while, for loops, Nested loops.	14
Unit-3 Arrays - One Dimensional arrays - Declaration, Initialization and Memory representation. Two Dimensional arrays - Declaration, Initialization and Memory representation. Structures - Structure Definition, Advantages of Structure, declaring, initialization accessing structure members. Unions - Union definition, declaration, initialization. difference between Structures and Unions.	12
Unit-4 Pointers in C - Definition, Declaring and initialising pointers, accessing address and value of variables using pointers,Pointer Arithmetic, Advantages and disadvantages of using pointers. User Defined Functions - Need , structure of C user defined functions.Categories of user defined functions - With and without parameters and return type. function call - call by value, call by reference.	12

References

1. E. Balagurusamy: Programming in ANSI C (TMH)
- 2.V. Rajaraman: Programming in C (PHI – EEE)
- 3.S. Byron Gottfried: Programming with C (TMH)
- 4.Yashwant Kanitkar: Let us C
- 5.Kamathane: Programming with ANSI and TURBO C (Pearson Education)

Course Code: 24BCA13	Mathematical Foundation
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Set and Function Definition of set, methods of representation of sets (property method and listing method), set operation (union, intersection, complement, Cartesian product of sets), properties of sets (commutative, associative and distributive), Definition of function, types of function (linear, quadratic, polynomial) with example, exponential and logarithmic function with their properties and related example.	14
Unit-2 : Matrix and Determinants: Introduction-Types of matrices-matrix operations-transpose of a matrix -determinant of matrix -inverse of a matrix, Cramer's rule, finding rank of a matrix – normal form-echelon form, Cayley Hamilton Theorem-Eigenvalues.	14
Unit-3 : Logic, Counting and Proof Propositions and Logical Operations, Conditional Statements, Methods of Proof, Counting-Permutations, Combinations, Pigeonhole Principle, Elements of Probability. Introduction to Proofs, Proof Methods and Strategy.	12
Unit-4 :Graphs Introduction to Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Colouring.	12

References

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012.
2. P. R. Vittal-Business Mathematics and Statistics, Margham Publications, Chennai,
3. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003.
4. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI 1986.
5. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
6. Discrete Mathematical Structures, Trembley and Manohar.

Course Code: 24BCA11P	C Programming LAB
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1. Write a C Program to read radius and find surface area and volume of a sphere. 2. Write a C Program to read three numbers and find the biggest of three 3. Write a C Program to demonstrate library functions in math.h (at least 5) 4. Write a C Program to read a number, find the sum of the digits, reverse the number and check it for palindrome 5. Write a C Program to read percentage of marks and to display appropriate grade (using switch case) 6. Write a C program to read marks scored in 3 subjects by n students and find the average of marks and result (Demonstration of single dimensional array) 7. Write a C Program to remove Duplicate Element in a single dimensional Array 8. Program to perform addition and subtraction of Matrices PART- B 1. Write a C Program to find the length of a string without using built in function 2. Write a C Program to demonstrate string functions (at least 3). 3. Write a C Program to demonstrate pointers in C 4. Write a C Program to generate n prime number 5. Write a C Program to find the trace of a square matrix using function 6. Write a C Program to read, display and multiply two matrices using function 7. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters. 8. Write a C Program to demonstrate structure to read & display student information.

Course Code: 24BCA12P	Information Technology LAB
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
Part – A 1.Create biodata using word processor 2.Create timetable in word processor with text formatting 3.Create Content page with header and footer, including page number,date , title using word processor 4.Create Invitation card for College Event using word processor 5.Create a Presentation with content animation 6.Create a Presentation with Slide transition 7.Create student ID card with photo in Presentation PART- B 1.Create student marks card in Spreadsheet 2.Plot Bar Chart in Spreadsheet for tabular data 3.Plot Line Chart in Spreadsheet for tabular data 4.Create inventory Bill in Spreadsheet with formulas. 5.Create a Salary slip with Basic,DA,(20% of Basic Salary),HRA(8% of Basic Salary), and Deduction.(10% of Total Salary) using Spreadsheet 6. Demonstrate usage of Filters in Spreadsheet.

II SEMESTER

Course Code: 24BCA21	Data structure using C
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Data structures - Definition, Types of data structures - Primitive & Non-primitive, Linear and Nonlinear. Stacks - Definition and Representation of stacks, Operations on stacks.Applications of stacks; Infix, postfix and prefix notations, convert infix to postfix,Evaluation of postfix expression using stack.Recursive function -Definition ,Examples - Fibonacci number, factorial of number.	12
Unit-2 : Queues - Definition and Representation of queues; Types of queues – Simple queue and Operations , Circular queue and Operations. Priority queue (concept only), Double ended queue (concept only). Sorting – Selection sort, Bubble sort,insertion sort, Merge sort, Searching - Sequential Search, Binary search.	12
Unit-3 Linked list: Definition and Representation of linked list, Types of linked lists - Singly linked list, doubly linked list, Circular linked list; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation, Garbage collection . Doubly Linked List: Memory Representation of Singly Linked List and Doubly Linked Lists. Applications of Linked List.	14
Unit-4 Trees: Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; Binary tree: Type of binary trees - strict binary tree, complete binary tree, binary search tree; Array representation of binary tree. Traversal of binary tree; preorder, inorder and postorder traversal.	14

References

- 1.Ellis Horowitz and Sartaj Sahni: Fundamentals of Data Structures
- 2.Tanenbaum: Data structures using C (Pearson Education)
- 3.Kamathane: Introduction to Data structures (Pearson Education)
- 4.Y. Kanitkar: Data Structures Using C (BPB)
- 5.Kottur: Data Structure Using C
- 6.Padma Reddy: Data Structure Using C

Course Code: 24BCA22	Java Programming
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Object oriented concepts and paradigm, Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Arrays in java. String, Character, String Buffer. Objects and Classes: Basics of objects and classes in java, Constructors, destructor Visibility modifiers, Methods and objects and object lifecycle. this reference, I/O streams	14
Unit-2 : Inheritance - Inheritance in java, Super and subclass, Overriding, Object class, Polymorphism - Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class. Interfaces - Interfaces Vs Abstract classes, defining an interface, implementing interfaces ,extending interfaces.	12
Unit-3 Packages - Defining, creating and accessing a package, Understanding CLASSPATH, importing packages. Exception handling- Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally.	12
Unit-4 Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, GUI programming- Basic UI elements for labels, buttons, and text input/output - JFrame – main window container. JLabel, JButton, JTextField, JTextArea. Event and Event handling in java, Event types, Mouse and key events, Generic programming.	14

Reference Books:

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition,
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall
3. Object Oriented Programming with Java : Somashekara, M.T., Guru, D.S.,Manjunatha, K.S
4. Java 2 - The Complete Reference – Tata McGraw Hill publication.

Course Code: 24BCA23	Operating System
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Operating System: Definition, Early systems – Batch Systems, Multiprogramming, Time Sharing, Real time system, Handheld systems and Distributed systems. Open Source Operating Systems. Process Management: Process Concept- Process Definition, Process State, Process Control Block, Process scheduling- Scheduling Queues, Schedulers, Context switch. Inter process communication (IPC) .	12
Unit-2 : CPU Scheduling - CPU I/O burst cycle, CPU Scheduler, Preemptive scheduling, Dispatcher. Scheduling criteria, Scheduling Algorithms- First-Come-First-Served (FCFS), Shortest Job First (SJF), Priority Scheduling, Round Robin scheduling algorithms. Deadlocks - Definition with example, System Model, Deadlocks Characterization- – Necessary Conditions, Resource Allocation Graph, Methods for Handling Deadlocks - Deadlock Prevention, Deadlock Avoidance.	14
Unit-3 Memory Management - Logical and Physical Address Space, Swapping, Contiguous Allocation, Fragmentation, Paging, Segmentation. Virtual Memory: Definition, Demand Paging, Page Replacement Algorithms -First In First Out (FIFO), Optimal Page replacement. Thrashing.	12
Unit-4 File System - File Concepts, Attributes, Operations and Types of Files. File Access methods, Directory Structure, Protection and consistency semantics. File System Implementation- File System Structure, File Allocation Methods, Free Space Management. Disk Structure, Disk Scheduling-Definition, Algorithms- FCFS, SSTF, SCAN.	14

References :

1. Operating System Concepts, Silberschatz' et al., 10th Edition, Wiley, 2018.
2. Operating System Concepts - Engineering Handbook, Ghosh PK, 2019.
3. Understanding Operating Systems, McHoes A et al., 7th Edition, Cengage Learning, 2014.
4. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson.
5. Operating Systems – A Concept Based Approach, Dhamdhare, 3rd Edition, McGrawHill Education India.
6. Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson

Course Code: 24BCA21P	Data Structure Lab using C
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
Part - A 1. Write a C Program to find GCD using recursive function 2. Write a C Program to generate N Fibonacci numbers using a recursive function. 3. Write a C Program to generate Factorial of a given number using a recursive function. 4. Write a C Program to sort the given list using Bubble sort technique. 5. Write a C Program to sort the given list using selection sort technique. 6. Write a C Program to sort the given list using insertion sort technique 7. Write a C Program to sort the given list using merge sort technique - recursive 8. Write a C Program to search an element using linear search technique PART- B 1. Write a C Program to implement Stack. 2. Write a C Program to convert an infix expression to postfix. 3. Write a C Program to implement a simple queue. 4. Write a C Program to implement a Circular queue. 5. Write a C Program to implement insert at the beginning of a singly linked list and display. 6. Write a C Program to delete a node at the end of a singly linked list. 7. Write a C Program to search an element using recursive binary search technique. 8. Write a C Program to implement inorder traversal of a binary tree.

Course Code: 24BCA22P	JAVA Programming LAB
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
Part A – 1. Write a java program that reads marks of 5 subjects, calculates total and percentage, and displays the grade (A, B, C, D, F) using if-else and for loop. 2. Write a java program to create a class with overloaded methods area() to compute area of circle, rectangle, and triangle using different parameter lists. 3. Write a java program that uses methods of the Math class to compute square root, power, maximum, minimum, and absolute value of given numbers. 4. Write a Java program that stores 10 integers in an array and displays the sum, maximum, and minimum values using loops. 5. Write a java program that uses the String and StringBuffer classes to perform concatenation, substring, reverse, insert, append, 6. Write a java program, create a program that uses the File class to create a file, write student details into it, and read and display the contents. 7. Write a java program to design an Employee class with empId, name, basicSalary. Implement methods to calculate DA (60% of basic), HRA (15% of basic), PF (12% of basic), and net salary. Create multiple Employee objects and display their details. Part B – 1. Write a java program to create a base class Student with name and rollNo, and a derived class Exam that adds marks and a method to display result. Use super keyword in the constructor. 2. Write a java program to create a package containing classes Student and Marks. Write another program outside the package that imports mypackage and uses these classes. 3. Write a Java program that takes two integers and performs division. Use try-catch to handle ArithmeticException and display a meaningful error message. 4. Write a GUI program that displays the coordinates of the mouse pointer when the user clicks or moves the mouse inside a panel. Use MouseListener and MouseMotionListener. 5. Write a java program to create a GUI window with a JTextField. Display a message whenever the user presses a key, using KeyListener to capture key events. 6. Write a java program to design a GUI calculator with buttons for digits and operators (+, -, *, /). Use ActionListener to perform calculations and display the result in a JTextField. 7. Write a generic method public static <T extends Comparable<T>> T findMax(T a, T b, T c) that returns the maximum of three values. Test it with Integer, Double, and String.

III SEMESTER

Course Code: 24BCA31	Database Management Systems	
Course Credits: 04	Teaching Hours per Week: 04	
Total Contact Hours:52	Internal Assessment : 20	
Exam Duration: 03	Semester end Exam Marks: 80	
Contents		hours
Unit-1 : Introduction to Database : Database system applications.Characteristics and Purpose of database approach. People associated with a Database system. Data models. Database schema. Database architecture. Data independence . Database languages, E-R Model: Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes.Relationships between the entities. Relationship types, structural constraints. Weak entity types, E -R diagram - examples.		14
Unit-2 : Relational Data Model: Relational model concepts. Characteristics of relations. Relational model constraints: Domain constraints, key constraints, integrity constraints Relational Algebra: Basic Relational Algebra operations-union ,intersection, selection, projection, cartesian product. JOIN operations.- inner , outer, equi .		12
Unit-3 SQL and Data Normalization: SQL -DML,DDL,DCL,TCL Commands. Aggregate Functions and Grouping. Nested Sub Queries, Views. Normalization - Anomalies in relational database design. . Functional dependencies. Normalization.Types of Normal forms- First normal form, Second normal form, Third normal form. Boyce-Codd normal form.		12
Unit-4 Introduction to PL/SQL programming: Features and Advantages, PL/SQL Blocks - basic syntax, Variables and their scope, Constants, Literals, Data Types, Operators, Executable Statements. Conditional Control: IF Statements , CASE Statements ,Iterative Control: Basic Loops - WHILE and FOR Loops, Reverse FOR LOOP Statement, Nested Loops, Labeling a PL/SQL Loop, exception handling.		14

References:

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson, 2015
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6 th Edition, McGraw Hill, 2010.
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3 rd Edition, McGraw Hill, 2002

Course Code: 24BCA32	Design and Analysis of Algorithms
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction: Fundamentals of Algorithmic problem solving, strategies to design algorithms ,Limitations and Improvements .Basics of Time Complexity .Fundamentals of the Analysis of Algorithm Efficiency (Worst-case, Best-Case and Average-case efficiencies) , Analysis Framework, Orders of Growth(logarithmic, linear, polynomial, exponential, factorial),	12
Unit-2 : Asymptotic Notations and Basic Efficiency classes, Informal Introduction, O-notation, Ω -notation, θ -notation, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms. Brute Force :(definition ,algorithm, example, analysis, advantage, limitation) Sequential Search :	12
Unit-3 Greedy Algorithms -(definition ,algorithm, example, analysis,advantage, limitation) Huffman Coding: Optimal prefix codes for data compression. Fractional Knapsack Problem: Maximizing value with weight constraints. Divide and Conquer : (definition ,algorithm, example, analysis,advantage, limitation) Binary Search : Analysis and variants. Merge Sort : Algorithm, analysis, and recurrence relation.	14
Unit-4 Dynamic Programming :(definition ,algorithm, example,analysis of time complexity ,advantage, limitation) -Longest Common Subsequence (LCS) All-Pairs Shortest Paths : Floyd-Warshall Algorithm. Graph Algorithms : (definition ,algorithm, example, analysis of time complexity ,advantage, limitation) .Types of Graphs,Graph Representations. Breadth-First Search (BFS). Depth-First Search (DFS).	14

References :

1. **"Introduction to Algorithms"** by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (CLRS) (MIT Press) - *The definitive textbook, highly recommended.*
2. **"Algorithm Design"** by Jon Kleinberg and Éva Tardos (Pearson Addison Wesley) - *Excellent for design paradigms.*
3. **"The Algorithm Design Manual"** by Steven S. Skiena (Springer) - *Great for practical insights and problem-solving.*

Course Code: 24BCA33	Computer Communication and Networks
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction: Computer Network-Types & Applications, Network Software Protocol Hierarchies, Network Topologies: Mesh, Star, Bus, Ring, Tree, Hybrid. Network Types: LAN, WAN, MAN, PAN. Network Models : OSI reference model, TCP/IP reference model, Comparison between OSI & TCP.	14
Unit-2 : Physical Layer : Data and Signals,Data Rate Limits, Transmission Media – Twisted pair, coaxial cable, optical fiber,radio transmission, microwave transmission and infrared transmission, switching – Circuit switching, Packet switching, Difference between Circuits witching & Packet switching.	12
Unit-3 Data Link Layer : Data Link Layer design issues, Error detection – Types of Errors,Single parity checking, Checksum, polynomial codes – CRC, Error correction- Hamming code, data link protocols- Unrestricted Simplex Protocol and Simplex Stop-and-Wait Protocol	12
Unit-4 Network Layer: Network layer design issues, Routing algorithms –Distance Vector Routing , Link State Routing (OSPF) , IPv4 Packet Format, Transport Layer : Transport Service primitives, UDP header &TCP segment header,Difference between TCP & UDP. Congestion & Congestion control algorithms – General Principles of Congestion control, Traffic Shaping-Leaky bucket algorithm, token bucket algorithm.	14

References :

1. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education, 2010.
- 2.Data Communication & Networking, Behrouza A Forouzan, 3rd Edition, Tata McGrawHill, 2001.
- 3.Data and Computer Communications, William Stallings, 10 th , Edition, PearsonEducation, 2017.
4. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI, 2012.
5. Data Communication & Network, Dr. Prasad, Wiley Dreamtech.
6. <http://highered.mheducation.com/sites/0072967757/index.htmls>

Course Code: 24BCA31P	DBMS Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1. Create a table Students with fields: StudentID (Primary Key)Name (VARCHAR)Age (INT)Grade (CHAR).Alter the Students table to add a new column Email (VARCHAR).Rename the Students table to display. 2. Create a table employee table(employee_id, employee_name, employee_dept salary) , insert 5 records into the employee table. perform Update the salary on table referencing the key ,example employee_id = XX . 3.Implementation of different types of constraints.-PRIMARY KEY, FOREIGN KEY, UNIQUE, CHECK. 4. Create two table and Demonstrate different types of Joins operations a) Inner Join b) Outer Join c) Natural Join 5.Create student table and Implement Aggregation Functions a) Group By & having clause b) Order by clause PART- B 1.Write a simple anonymous PL/SQL block to display "Hello, PL/SQL World!". 2.Write a PL/SQL block to check if a number is positive, negative, or zero. 3.Write PL/SQL blocks to demonstrate NO_DATA_FOUND, TOO_MANY_ROWS, ZERO_DIVIDE, DUP_VAL_ON_INDEX 4.Create Simple Cursor : Write a PL/SQL block to retrieve and display the employee_id and employee_name for all employees from an employees table (assume it exists with these columns). display employee names with distinct salaries. 5.Create Simple Cursor : Write a PL/SQL block to retrieve and display the student table and Create a program to categorize students based on CGPA: 'A' for CGPA ≥ 9 , 'B' for CGPA ≥ 7, 'C' for CGPA ≥ 4 , 'D' for others.

Course Code: 24BCA32P	ADA Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1. Write a program to demonstrate Time complexity - constant and logarithmic time 2. Write a program to demonstrate Time complexity - linear and quadratic time 3. Write a program to find element using sequential search. 4. Write a program to sort a list of N elements using Selection Sort Technique 5. implement Merge sort algorithm for sorting a list of integers in ascending order. 6. Write a program to perform Knapsack Problem using Greedy Solution 7. Write a program to perform Travelling Salesman Problem PART- B 1. Write a program to show graph representation basics. 2. implement binary search to demonstrate divide and conquer. 3. implement Greedy Algorithm for job sequencing with deadlines. 4. implement a Dynamic Programming algorithm for the Longest Common Subsequence. 5. implements Prim's algorithm to generate minimum costs spanning Tree. 6. implement the DFS algorithm for a graph. 7. implement the BFS algorithm for a graph

IV SEMESTER

Course Code: 24BCA41	Python Programming
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours:52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Features and Applications of Python, Python Versions, Installation of Python, Python IDEs, Simple Python Program. Comments, Indentation. Identifiers, Variables, Operators, Precedence and Association, Python Libraries : Importing Libraries ,installing new packages. Libraries overview - NumPy,Pandas ,Matplotlib. Built-in Data Type - int, float, complex . Type Conversions Built-in Functions - Console Input and Console Output.	14
Unit-2 : Strings : Creating and Storing Strings; Accessing String Characters, String Methods : Concatenation, Comparison, Slicing and Joining, Format Specifiers. Python Control Flow : Types of Control Flow, Control Flow Statements-if, else, elif, nested if, while loop, break, continue statements, for loopStatement; range () and exit () functions, pass statement. Python Functions : Types of Functions, Function Definition-Syntax,Function Calling, Passing Parameters/arguments, the return statement,Default Parameters; keyword Arguments; Recursive Functions.	14
Unit-3 Arrays : Creating Array, Access the element of an array, Arrays Built-in Methods. Lists : Creating Lists,Operations on Lists, Built-in Functions on Lists,Nested Lists. Dictionaries : Creating Dictionaries, Operations on Dictionaries, Dictionary Built-in Methods, Populating and Traversing Dictionaries. Tuples : Creating Tuples, Operations ,Tuple Built-in Methods. Sets :Creating Sets,Operations ,Set Built-in Methods.	12
Unit-4 Object Oriented Programming : Classes and Objects, Creating Classes and Objects, Constructor Method, Classes with Multiple Objects, Objects as Arguments, Objects as Return Values. File Handling : File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator. Exception Handling : Types of Errors, Exceptions,Exception Handling using try, except and finally.	12

References :

1. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition,
2. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
3. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language, Fabio Nelli, Apress®, 2015
4. Advanced Core Python Programming, MeenuKohli, BPB Publications, 2021.
5. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, Prentice Hall, 2012.
6. Automate the Boring Stuff, Al Sweigart, No Starch Press, Inc, 2015.
7. Data Structures and Program Design Using Python, D Malhotra et al., Mercury Learning and Information LLC, 2021.

Course Code: 24BCA42	Web Technologies
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : HTML Basics : HTML Document Structure, Text Formatting Tag:Headings: <h1> to <h6>. : <p>. . Horizontal Rule: <hr>. , . <i>, . : <sup>, : <sub> Metadata Tags - <title>, <link>, <style>, <script> Media Tags - ,anchor <a>, Images , Lists Table related Tags<table>:<thead>, <tbody>, <tfoot> , <tr>, <th>,<td>. Form-related Tags: <form>: <input>: Input fields (text, number, checkbox, radio, etc.).<button>: <select>, <option>: Drop-down lists.<label>. HTML Attributes: id, class, style, title. HTTP Methods: GET, POST, HTTP Status Codes	14
Unit-2 : JavaScript : General syntactic characteristics, Primitives, operations, and expressions, Control Structures, Error Handling , user define function, Event handling. DOM Manipulation: Tree Structure, Selecting Elements-getElementById, querySelector. Object and Functions : document ,window, console object Properties and Functions . Frameworks Introduction :Node.js & npm .	14
Unit-3 Introduction to CSS : Overview and features of CSS3. CSS Syntax, Selectors, Box Model. CSS Selectors and Specificity. Type of CSS, . CSS Box Model: margin, border, padding, Box-sizing , Borders ,Measurements. Positioning, CSS Grid Layout. Pseudo-classes: :hover, :active, :focus, :first-child, :last-child, :nth-child(),	12
Unit-4 CSS Animation : Keyframes Properties ,Syntax, 2D Transforms Functions . CSS Transitions : CSS Transition Properties ,Syntax, example. HTML5- SVG : Viewing SVG Files, Embedding SVG in, SVG Circle, SVG Rectangle, SVG Line. HTML5-CANVAS : Browser Support, Canvas Examples, Canvas - Drawing Rectangles, Canvas - Drawing Paths, Canvas - Drawing Lines.	12

References :

1. "Web Technologies: A Developer's Perspective" by N. P. Gopalan and J. Akilandeswari (PHI Learning) - *Good for foundational web concepts.*
2. "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Robbins (O'Reilly Media) - *Excellent for beginners, covering the basics comprehensively.*
- 3.] "HTTP: The Definitive Guide" by Brian Totty, et al. (O'Reilly Media) - *For a more in-depth understanding of HTTP, though parts might be too advanced for Chapter 1*

Course Code: 24BCA43	Software Engineering
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Software Engineering, Software engineering ethics. Software process. Software process models: Waterfall Model, Incremental Model, Evolutionary Models. Agile software development: Principles of Agile, Requirements Engineering: Feasibility Study, Requirements Elicitation, Requirements Analysis, Requirements Specification, Requirements Management , Requirements Modeling: Use Case Diagrams, Sequence Diagrams,	13
Unit-2 : Software Design :Design Process and Quality Attributes (Maintainability, Reliability, Usability, Performance, Security,).Design Concepts: Abstraction, Architecture, Patterns, Modularity, Information Hiding, Functional Independence.Coupling and Cohesion. Architectural Design: Layered, Client-Server, Peer-to-Peer, Pipe-and-Filter, Microservices.	13
Unit-3 Component-Level Design: Class diagrams, interaction diagrams. Designing Components(concept, representation ,example): Flowcharts, pseudocode. User Interface Design (UI/UX Principles):Golden rules of interface design,User interface analysis and design process,Prototyping and evaluation.	13
Unit-4 Software Testing Fundamentals (concepts): Verification vs. Validation.Testing Principles.Testability.Test Plan, Test Case, Test Report. Testing Strategies: Unit Testing: White-box testing (basis path testing, control structure testing), black-box testing (equivalence partitioning, boundary value analysis). Integration Testing: Top-down, bottom-up, sandwich, regression testing. Validation Testing: Alpha, Beta testing, user acceptance testing.	13

References :

1. **"Software Engineering: A Practitioner's Approach"** by Roger S. Pressman and Bruce Maxim (McGraw-Hill Education) - *A classic and comprehensive guide for practitioners.*
2. **"Software Engineering"** by Ian Sommerville (Pearson Education) - *Covers a broad range of topics with a strong focus on fundamental concepts*

Course Code: 24BCA41P	Python Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1. Write a Program to Check if a given number is a Prime Number or not 2. Write a Program to check if number is positive, negative or zero 3. Write a Program to Count Digits in a Number using while loop 4. Write a Program to generate random number and Calculate the sum of elements using for loop 5. Write a Program to remove punctuations from a string 6. Write a Program to find factorial of a number 7. Write a Program to Create a calculator program PART- B 1. Demonstrate basic operation on list - sum() ,max() , min() ,sort(). 2. Write a Program to Demonstrate use of Tuples 3. Write a Program to Demonstrate use of Dictionaries 4. Write a python program to create Simple Class and Object 5. Write a Program to count number of lines in a text file 6. Write a Program to Create data frame from excel sheet and perform simple operations 7. Write a Program to Demonstrate exception handling

Course Code: 24BCA42P	Web Technologies Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1. Develop and demonstrate a HTML document that illustrates a) Image as a background 2. Multimedia: - a) Develop a web page to play audio file using <a>Tag. b) Develop a web page to play video file using <Embed>Tag. 3. Develop and demonstrate a HTML document that illustrates a) the use of Formatting Text. b) Headings tags (H1, H2, H3, H4, H5, H6) c) Font Details (Font Size, Style, Type, Color) d) Setting Color (BG Color) 4. Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit 5. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format. 6. Demonstrate canvas in HTML5. PART- B 1. Develop and demonstrate a HTML document that illustrates a) Unordered List (UL) b) Ordered List (OL) and Definition list (DL) c) Table Alignment (Cell Spacing, Cell Padding, Height, Width, Border, Rowspan, colspan) d) Setting Different Table Attributes (Color, Image) 2. Create Style sheet to set formatting for text tags and embed that style sheet on web pages created for your site. 3. Design a timetable and display it in tabular format using html. 4. Design signup form to validate username, password, and phone numbers etc. using Java script 5. Write an HTML page that contains a selection box with a list of 5 countries .. Add CSS to customize the properties of the font of the capital (color, bold and font size).

V- Semester

Course Code: 24BCA51	PHP and MY SQL
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to PHP History of PHP, Client-Side vs. Server-Side scripting, and the Role of a Web Server (Apache/Nginx). Installation: Setting up local environments like XAMPP, WAMP, Basic Syntax: PHP tags (<?php ... ?>), comments, echo and print. Comments in PHP. Data types, Keywords, Constants, Expressions, Operators. Conditional statements: if, if-else, switch, ? Operator, Looping statements: while Loop, do-while Loop, for Loop. Arrays in PHP: Types: Indexed, Associative, and Multidimensional arrays. Array Functions: array_push, array_pop, sort, count, and merging arrays.	14
Unit-2 : Including and Requiring Files- use of Include() and Require(), Cookies: Setting, retrieving, and deleting browser-side data. Sessions: Starting sessions, storing \$_SESSION variables, and session security. User-Defined Functions: Creating reusable code blocks, parameters, and return values. Variable Scope: Local vs. Global variables and the static keyword. Library functions, Date and Time Functions.	12
Unit-3 Class & Objects in PHP: What is Class & Object, Creating and accessing a Class & Object, Access Modifiers, Object properties, object methods, Overloading, inheritance, Constructor and Destructor. Magic Methods. \$this Keyword Form Handling: Creating HTML Form, Handling HTML Form data in PHP File Handling: Opening, reading, writing, and closing files on the server using functions like fopen, fwrite, and fclose.	12
Unit-4 : Introduction to MySQL: MySQL Client - phpMyAdmin. Database Connectivity: Connecting to MySQL using mysqli or PDO (PHP Data Objects). CRUD Operations: Writing SQL queries within PHP to Create , Read , Update , and Delete database records. PHP MySQL Functions, Connecting to MySQL and Selecting the Database, Executing Simple Queries, Security & Error Handling: Preventing SQL Injection and XSS attacks. Using try-catch blocks for Exception Handling.	14

References

1. PHP & MySQL for Dynamic Web Sites-Fourth Edition By Larry Ullman.
- 2 Learning PHP, MySQL and JavaScript By Robin Nixon –O “REILLY Publications.
- 3 Programming PHP By Rasmus Lerdorf, Kevin Tatroe, Peter Mac

Course Code: 24BCA52	Artificial Intelligence and Machine Learning
Course Credits: 4	Teaching Hours per Week: 4
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
UNIT 1: FUNDAMENTALS OF AI & INTELLIGENT AGENTS: <i>Introduction to AI:</i> Definition, History of AI, The Turing Test, Applications of AI. <i>Intelligent Agents:</i> Definition of Agent and Environment, Sensors and Actuators. <i>Structure of Agents:</i> Simple Reflex Agents, Model-Based Agents, Goal-Based Agents, Utility-Based Agents. <i>AI Ethics:</i> Basic Introduction to Ethics and Safety in AI.	13
UNIT 2: PROBLEM SOLVING & KNOWLEDGE REPRESENTATION <i>Problem Solving:</i> Defining the problem, State Space Search. <i>Uninformed Search Strategies:</i> Breadth-First Search (BFS), Depth-First Search (DFS) (Algorithm and Logic). <i>Informed Search Strategies:</i> Heuristic Functions, Hill Climbing, A* Search Algorithm. <i>Knowledge Representation-</i> Knowledge-Based Agents, The Wumpus World,	13
UNIT 3: FUNDAMENTALS OF ML & SUPERVISED LEARNING <i>Introduction to ML:</i> Definition, AI vs. ML vs. DL, The Machine Learning Process (Data Collection, Pre-processing, Training, Testing). <i>Supervised Learning:</i> Regression: Simple Linear Regression (Concept & Applications). <i>Classification:</i> K-Nearest Neighbors (KNN), Decision Trees (Basic Construction), Naive Bayes Classifier. <i>Model Evaluation:</i> Training Set vs. Testing Set, Confusion Matrix, Accuracy.	13
UNIT 4: UNSUPERVISED LEARNING, NEURAL NETWORKS & TRENDS <i>Unsupervised Learning:</i> Introduction to Clustering, K-Means Clustering Algorithm. <i>Artificial Neural Networks (ANN):</i> The Perceptron, Activation Functions (Sigmoid, ReLU), Multi-Layer Perceptron (MLP). <i>Deep Learning (DL):</i> Introduction to Deep Learning, Difference between Shallow and Deep Networks, Convolutional Neural Networks (CNN) – Basic Concept. <i>Modern Trends:</i> Overview of Generative AI and Large Language Models (LLM).	13

References

1. V. Chandra, *Artificial Intelligence and Machine Learning*, Pearson.
2. Tom Taulli, *Artificial Intelligence Basics: A Non-Technical Introduction*.
3. Vinod Chandra S.S., *Artificial Intelligence and Machine Learning*, PHI Learning.

Course Code: 24BCA53	Cyber Security
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	12
Unit-2 : Cyber-crime and Cyber law: Classification of cyber-crimes, Common cyber-crimes- cyber-crime targeting computers and mobiles, cyber-crime against women and children, financial frauds, social engineering attacks, malware and ransom ware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber-crimes, Remedial and mitigation measures, Legal perspective of cyber-crime, IT Act 2000 and its amendments.	12
Unit-3 : Security Concepts: The CIA Triad ,Security Attacks (Passive vs. Active). OSI Security Architecture. Classical Encryption Techniques: Substitution Ciphers: Caesar Cipher, Monoalphabetic, Polyalphabetic , Playfair, and Hill Cipher. Transposition Ciphers: Rail Fence and Columnar Transposition.Stream Ciphers: RC4 and the concept of Keystreams. Public Key Cryptosystems: Principles of asymmetric encryption. RSA Algorithm: Key generation, encryption, and decryption . Data Encryption Standard (DES): DES structure.	14
Unit-4 : Transport-Level Security: SSL/TLS , HTTPS, and SSH (Secure Shell). Email Security: PGP and S/MIME. IP Security (IPsec): Encapsulating Security Payload (ESP) and Authentication Header. System Security: Intrusion Detection Systems (IDS), Firewall design principles, and Malicious Software . Cryptographic Hash Functions: MD5, SHA-1, SHA-256, and SHA-512 principles. Digital Signatures: Digital Signature Standard (DSS) and authentication protocols. Authentication Applications: Kerberos and X.509 Directory Authentication.	14

References

- 1.Cyber Crime Impact in the New Millennium, by R. C Mishra, Author Press. Edition 2010
- 2.Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
- 3.Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
- 4.Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
- 5.Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Course Code: 24BCA51P	PHP Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART- A 1 Write a PHP script to swap two numbers. 2 Write a PHP script to find the factorial of a number. 3 Write a PHP script to reverse a given number and calculate its sum. 4 Write a PHP script to generate a Fibonacci series 5 Write a PHP script to implement constructor and destructor. 6 Write a PHP script to implement form handling using the get method. 7 Write a PHP script to implement form handling using the post method. PART- B 8 Write a PHP script that receives form input by the method post to check the number is prime or not. 9 Write a PHP script that receives a string as a form input. 10 Write a PHP script to compute the addition of two matrices as a form input. 11 Write a PHP script to show the functionality of the date and time function. 12 Write a PHP program to upload a file. 13 Write a PHP script to implement database creation. 14 Develop a PHP program to design a college admission form using the MYSQL database.

Course Code: 24BCA52P	AI and ML Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART- A 1. Write a simple Python program using if-else statements to simulate a chat with the user (e.g., User: "Hi", AI: "Hello! How are you?"; User: "Bye", AI: "See you!"). 2. Write a Python program to simply display a 3x3 Tic-Tac-Toe board and ask the user to input a position (1-9) to place an 'X'. (Focus on State Representation, not full game logic). 3. Write a program to simulate a Vacuum Cleaner. Use a variable status = "dirty" or status = "clean". If dirty, print "Cleaning...". If clean, print "Moving...". 4. Write a program where the user manually selects options (e.g., "1. Fill Jug A", "2. Empty Jug B") to reach a goal state of 2 Litres. (Simulation only). 5. Write a program to traverse a small hardcoded graph (e.g., Node A connected to B and C) using the Depth First Search logic. PART- B 1. Write a program to demonstrate Simple Linear Regression to predict a value (e.g., Study Hours vs. Marks) using a hardcoded dataset. 2. Write a program to demonstrate Logistic Regression to predict a "Pass" or "Fail" outcome based on study hours. 3. Write a program to demonstrate a Decision Tree Classifier to classify data (e.g., Apple vs. Orange based on weight/texture) using hardcoded data. 4. Write a program to demonstrate K-Means Clustering to group a list of numbers (e.g., [2, 4, 100, 102]) into two clusters. 5. Write a program to demonstrate the AND Gate logic using a Perceptron or simple condition-based learning.

DISCIPLINE ELECTIVE 1-V SEMESTER

Course Code: 24BCAE51	Data Mining and Data Warehouse
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Data Mining: Introduction, Data, Types of Data ,Data Mining Definitions, Types of data mining, DM Applications. Data Mining Architecture , Knowledge Discovery Process (KDD).Data Cleaning: Handling missing values, noisy , and inconsistent data. Data Integration & Transformation: Combining multiple sources and normalizing data (Min-Max, Z-score scaling). Data Reduction: Dimensionality reduction and Data Compression	12
Unit-2 : Data Warehouse Basics: Difference between Operational Database Systems (OLTP) and Data Warehouses (OLAP). Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellation schemas. OLAP Operations: Roll-up, Drill-down, Slice, Dice, and Pivot. Architecture: Three-tier Data Warehouse architecture and Metadata repository.	12
Unit-3 : Association Rules: Market Basket Analysis, Frequent Itemsets, and the Apriori Algorithm. FP-Growth Algorithm. Classification Fundamentals: What is classification? (Supervised learning). Decision Tree Induction: ID3/C4.5 algorithms and attribute selection measures (Information Gain, Gini Index). Bayesian Classification: Naïve Bayes Theorem and Bayesian Belief Networks	14
Unit-4 : Cluster Analysis: Requirements and types of data in cluster analysis. Partitioning Methods: K-Means and K-Medoids (PAM) algorithms. Hierarchical Methods: Agglomerative (Bottom-up) and Divisive (Top-down) clustering. Density-Based Methods: DBSCAN algorithm for discovering clusters of arbitrary shapes. Outlier Analysis: Identifying anomalies in data. Mining Complex Data: Text Mining, Web Mining, and Spatial Data Mining.	14

References:

- 1.Jiawei Han and Micheline Kambar –“Data Mining Concepts and Techniques”.
- 2 Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining.
- 3 Arun K Pujari– “Data Mining Techniques”, 4th Edition,Universities Press.
- 4 K.P.Soman, Shyam Diwakar, V.Ajay: Insight into Data Mining– Theory and Practice, PHI.

DISCIPLINE ELECTIVE 2-V SEMESTER

Course Code: 24BCAE52	Unix Operating System
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Unix/Linux Architecture History: Origin of Unix (AT&T Bell Labs) and the rise of Linux (Linus Torvalds, GNU). System Architecture: The layered structure—Hardware, Kernel, Shell, and User Applications. The Kernel: role in process management, memory allocation, and hardware abstraction. The Shell: Introduction to different shells (Bourne, Bash, C Shell, Korn) basic utilities command : date, cal, who, tty,	12
Unit-2 :The File System, Hierarchical File System: The root directory (/), home directories, and system paths (/bin, /etc, /dev, /tmp). File Manipulation: Commands for navigation (cd, pwd, ls) and file management (cp, mv, rm, mkdir, rmdir). File Permissions: the rwx (Read, Write, Execute) bits for User, Group, and Others using chmod, chown, and chgrp. Text Processing: editor vi/vim and nano. Basic filters -cat, head, tail, sort, uniq, and grep.	14
Unit-3 :Process Concepts Process ID (PID), Parent-Child relationships, and the init (or systemd) process. Process Control Commands:—ps, top, nice, kill, and background/foreground processing (&, fg, bg). Scheduling: Automating tasks using cron and at. User & Group Management: Adding users, managing passwords, and switching identities (sudo, su). Networking Basics: Configuring interfaces, troubleshooting with ping, ifconfig/ip, and remote access via ssh.	12
Unit-4 :Shell Variables: Environment variables vs. user-defined variables. Positional Parameters: Handling command-line arguments (\$1, \$2, \$#). Control Structures: Logic using if-then-else, case statements, and loops (for, while, until). Arithmetic in Shell: Performing calculations using expr or (()). Advanced Tools: Introduction to sed (Stream Editor) and awk for complex data pattern matching and reporting.	14

References :

- 1.UNIX Concepts and Applications by Sumitabha Das.
- 2.Advanced Programming in the UNIX Environment by W. R. Stevens ,Addison Wesley.
- 3.UNIX and Linux System Administration Handbook by Evi Nemeth, Addison Wesley.
- 4.The UNIX Programming Environment Brian by Kernighan Prentice Hall .

VI- Semester

Course Code: 24BCA61	Full Stack Development
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to Full Stack Development : Front-end Technologies (client-side) . back-end Technologies (server-side). Advantages of full stack development. Databases. Stacks :MERN Stack, MEAN Stack, LAMP Stack, Package managers (npm, yarn) - APIs and Services. Version controlling : Git and GitHub. Bootstrap : Bootstrap Layout Basics ,Components ,Navigation .Advantages of using CSS frameworks. jQuery:Basic Syntax, operations, Event Handling & Interaction .AJAX Fundamentals,	12
Unit-2 : Front-End Framework : Introduction to React.js . JSX & Elements -embedding expressions using {}. Component Architecture: Functional Components,.Class Components,Lifecycle Methods,Properties, Immutability of props. State Management: Internal State, Lifting State Up. React Hooks : useState ,useEffect, useContext,useRef. Advanced Patterns: Conditional rendering (Ternary/&&), Mapping lists with unique key props, and Fragmenting. Event Handling : React event system, Handling events (click, submit, change) ,Synthetic events.	14
Unit-3 Back-End Framework Node.js & The NPM Ecosystem,Features. installing Node.js & npm ,Node.js REPL environment Node.js Architecture:V8 engine ,Single-threaded model ,Event loop & callbacks. Node Core Modules: Reading, writing, and deleting files. http: Creating a low-level web server. path & os: Handling file paths and system information. NPM Scripts: Automating tasks -npm start, npm run dev.Local vs. Global installations. Asynchronous Patterns: Promises , Async/Await .	12
Unit-4 Databases - NoSQL: Differences between RDBMS (SQL) and Document Databases (NoSQL). BSON (Binary JSON) : documents Structure,Fields. Firebase- Features, Firebase Ecosystem ,Firebase Studio , NoSQL - Cloud Firestore, Realtime Database, Serverless Logic & Modern Hosting. Security Rules. MongoDB database: Features , MongoDB Atlas ,MongoDB Compass ,Mongo Shell (mongosh), Applications of MongoDB.	14

References

- 1.Learning React: Modern Patterns for Developing React Apps ,Authors: Alex Banks & Eve Porcello Publisher: O'Reilly Media
- 2.Node.js in Action (2nd Edition) ,Authors: Alex R. Young, et al. Publisher: Manning Publications.

Course Code: 24BCA62	Cloud Computing
Course Credits: 04	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction: Different Computing Paradigms- Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing etc., Comparison of various Computing Technologies; Cloud Computing Basics- What is Cloud Computing? History, Characteristic Features, Advantages and Disadvantages, and Applications of Cloud Computing; Trends in Cloud Computing; Leading Cloud Platform Service Providers.	14
Unit-2 : Cloud Architecture: Cloud Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), Comparison of different Service Models; Cloud Deployment Models- Public Cloud; Private Cloud, Hybrid Cloud, Community Cloud. Cloud Computing Architecture- Layered Architecture of Cloud. Virtualization- Definition, Features of Virtualization; Types of Virtualizations. Pros and Cons of Virtualization. Technology (Xen: Paravirtualization, Microsoft Hyper-V).	12
Unit-3 : Cloud Platforms in Industry: Amazon Web Services(AWS)- Compute Services, Storage Services, Communication Services. Google Cloud Platform (GCP):Google AppEngine, Architecture and Core Concepts, Application Life-Cycle. Microsoft Azure- Azure Core Concepts : Compute, Storage, Core Infrastructure . Oracle Cloud Infrastructure (OCI): high-performance computing (HPC) IBM Cloud: hybrid cloud and heavily regulated industries (finance, healthcare), Open Shift for container management. Salesforce : cloud-based platforms for CRM and IT service management.	14
Unit-4 : Serverless Architectures: Event-driven programming for enterprise workflows. DevOps and CI/CD: cloud-native pipelines (AWS CodePipeline, Azure DevOps) to automate industrial software releases. Cloud Security: Shared Responsibility Model, Identity and Access Management (IAM), data encryption at rest and in transit. SLA and Management, Disaster Recovery. Cloud computing Applications.	12

References

- 1."Cloud Computing: Concepts, Tech & Architecture" Thomas Erl, Ricardo Puttini, Zaigham Mahmood Pearson Education / Prentice Hall
- 2."Cloud Computing: Principles and Paradigms" Rajkumar Buyya, James Broberg, Andrzej Goscinski John Wiley & Sons
- 3."The Cloud Computing Book" Douglas Comer Chapman and Hall/CRC

Course Code: 24BCA63	Big Data Analytics
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit1 : Foundations of Data Science: Definition and Scope of Data Science; Applications of Data Science, Data Science vs Data Analytics vs Data Engineering; Types of Data: Structured, Semi structured, Unstructured, Data collection methods, Data Preprocessing Concepts: Handling Missing Values, Duplicates, Outliers; Overview of Data Transformation Techniques: Normalization, Scaling, Encoding. Data Science Lifecycle: Collection, Cleaning, Exploration, Modelling, Interpretation; Overview of Data Sources: APIs, Open Datasets, Web Data.	14
Unit-2 : Introduction to Big Data, Elements of Big Data, Big Data Analytics, The 5 V's of Big Data: Volume, Velocity, Variety, Veracity, and Value. Types of Digital Data: Structured (SQL), Semi-structured (JSON/XML), and Unstructured (Video/Sensor data). Cloud Computing and Big Data, Cloud Computing, Cloud Services for Big Data. Ethics and Privacy: Overview of GDPR, data sovereignty, and the social implications of big data.	14
Unit-3 : Distributed and Parallel Computing for Big Data, Hadoop : HDFS and MapReduce, Introducing HBase- HBase Architecture, Storing Big Data with HBase, Spark and Architecture, Hive, Pig, Sqoop, ZooKeeper, Flume, Oozie. Storing Big Data in Databases: Issues with Relational Model, Big Data Analysis and Data Warehouse	12
Unit-4 :Real-Time Analytics- Apache Spark: Core architecture, RDDs (Resilient Distributed Datasets), and DataFrames .Spark Ecosystem: Spark SQL for structured data and MLlib for scalable machine learning. Stream Processing: Real-time data analysis using Spark Streaming or Apache Kafka. NoSQL Databases: Key-Value (Redis), Document (MongoDB), Columnar (Cassandra), and Graph (Neo4j) stores.	12

References

- 1."Big Data Analytics: Introduction to Hadoop, Spark, & ML" Raj Kamal & Preeti Saxena McGraw Hill Education
- 2."Distributed Systems: Concepts and Design" G. Coulouris, J. Dollimore, T. Kindberg Pearson Education.

Course Code: 24BCA61P	Full Stack Development Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
PART - A 1.Create a webpage with 3 column paragraph view using bootstrap 2.Write Ajax program to demonstrate get & post function. 3.Write Ajax program to create Filterable List. 4. Write a jQuery program to create a slide down panel div. 5. Write a jQuery program to create alerts on button click events. PART- B 1.write a React JS Program to build Counter Application. 2.Write aReact JS Program to build a To-Do List. 3.Write aReact JS Program to build a Digital Clock. 4.write Node.js program to Read a File Asynchronously. 5.write Node.js program to demonstrate Creating and Using of ‘Promises’.

Course Code: 24BCA62P	Project Lab
Course Credits: 02	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment: 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents
Guidelines: - 1. The project is of 4 Hours per week for one (Semester VI) Semester duration. 2. The synopsis approval will be given by the project Guides. 3. Groups should be not more than five members. 4. The project labs will focus on survey, planning, designing, coding and testing of the project. Report: The project proposal should include the following: ● Title ● Introduction ● Literature survey ● Objectives ● Design Details of modules and process logic ● Development/Implementation stages ● Testing Report ● Results (Any Other Components as per project requirements can be added by Project guide.)

DISCIPLINE ELECTIVE 1 –VI semester

Course Code: 24BCAE61	Internet of Things
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Contents	hours
Unit-1 : Introduction to IoT: Definition of IoT, evolution from M2M to IoT. Characteristics of IoT: Connectivity, Intelligence, Scale, Dynamic Nature. IoT Architecture: Three-Layer Architecture , Five-Layer Architecture Devices and Sensing : Sensors ,Actuators ,Microcontrollers and Microprocessors for IoT.	12
Unit-2 : IoT Network Structure, Wired Communication Protocols ,Wireless Communication Protocols -Short-Range, Long-Range / LPWAN. IoT Protocols : (Definition, advantage, disadvantage) MQTT (Message Queuing Telemetry Transport). CoAP (Constrained Application Protocol), AMQP (Advanced Message Queuing Protocol): WebSock	14
Unit-3 IoT Data Management: Data collection, filtering, aggregation, storage. IoT Analytics :Descriptive, Diagnostic, Predictive, Prescriptive Analytics in IoT. IoT Security Challenges : Vulnerabilities at different layers . IoT Security Measures : Authentication and Authorization ,Data Encryption	14
Unit-4 IoT Cloud Platforms : AWS IoT Core: Device Gateway, Device Shadow, Rules Engine, Microsoft Azure IoT Hub: Device Provisioning, Message Routing, IoT Edge. Google Cloud IoT Core: Device Management, Protocol Bridge, Pub/Sub	12

References

1. Internet of Things: A Hands-on Approach by Arshdeep Bahga and Vijay Madisetti Universities Press
2. Internet of Things: Architecture and Design Principles by Raj Kamal .McGraw Hill.
3. Internet of Things: Principles and Paradigms by Rajkumar Buyya and Amir Vahid Dastjerdi .Elsevier / Morgan Kaufmann

DISCIPLINE ELECTIVE 2 –VI semester

Course Code: 24BCADE62	Business Intelligence
Course Credits: 03	Teaching Hours per Week: 04
Total Contact Hours: 52	Internal Assessment : 20
Exam Duration: 03	Semester end Exam Marks: 80

Course Objectives

- Introduce fundamentals of Business Intelligence and analytics
- Understand data warehousing concepts and architectures
- Learn data integration, OLAP, and reporting techniques
- Apply BI tools for business decision-making
- Develop analytical thinking using real-world business data

Unit 1: Information Systems Support for Decision Making: The Concept of Decision Support Systems, Business Analytics Overview, Phases of the Decision Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Classification, Components.	14
Unit-2: Introduction to Business Intelligence, and the evolution from Decision Support Systems (DSS) to modern AI-driven BI. BI vs Data Analytics vs Business Analytics, BI architecture, BI lifecycle, Components of BI, BI Frameworks: Comparing Traditional BI vs. Self-Service BI, Understanding the flow from Data Sources → ETL → Data Warehouse → BI Tools. Need and importance of BI in organizations. overlaps, descriptive, diagnostic, predictive, and prescriptive analytics. Applications of BI: BI in marketing, finance, healthcare, education, e-commerce, and government sectors.	18
Unit-3: BI Tools, Visualization and Applications Business Intelligence Tools: Overview of popular BI tools and platforms. Reporting and Dashboards: Types of reports, dashboard components, interactive dashboards. Data Visualization: Principles of visualization, charts, graphs, best practices. BI Tools Exposure (Conceptual): Introduction to Power BI, Tableau, Qlik – features and use cases. Key Performance Indicators (KPIs): Definition, characteristics, KPI selection and measurement. Case Studies: Real-world BI applications in business decision making.	12
Unit 4: Hands-on with BI Tool Data Import, Data Transformation, Creating Reports, Creating Dashboards, Publishing Reports, Case Studies in: Retail Analytics , Banking Analytics, Healthcare Analytics, Education Analytics	8

Text Books:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, J. E. Aronson, Ting-Peng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10th Edition, Pearson Global Edition.
2. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback–12 November 2017 by Edward Miz

ELECTIVE I - BCA & B.Sc Cs III Semester

Course Code: 24BCAEL31/ 24BScEL31	Internet Basics
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	Hours
Unit-1: Internet Basics: Basic concepts, communicating on the Internet, Internet, Difference between the Internet and the World Wide Web (WWW). Basic networking concepts (LAN, WAN) Web server, Web browser – understanding how a browser communicates with a web server, Client issues a request and sends a response, server terminates the connection.	8
Unit-2: Search Engines: What are search engines and how do they work? Popular search engines (Google, Bing, DuckDuckGo). Effective search strategies (keywords, advanced search operators). Evaluating search results for credibility. Internet Service Providers (ISPs) and types of connectivity (Dial-up, Broadband, Wi-Fi, Fiber, Mobile Data)	8
Unit-3: Web Addresses (URLs): Structure of a URL (Scheme, Domain, Subdomain, Subdirectory). Top-Level Domains. Domain Name Extension, establishing connectivity on the internet, IP Address – assigning IP Address static / dynamic. Internet Protocols: TCP/IP. HTTP/HTTPS, FTP, DNS.	8
Unit- 4: Network hardware: Network Interface Devices, Network Interface Cards (NIC), Wired vs Wireless NICs, MAC Address and ARP, Networking Devices-Hubs, Switches, and Bridges, Routers-Routing basics, static and dynamic routing. Access Points (AP) Firewalls (Hardware)	8

References:

1. "The Internet Book: Everything You Need to Know about Computer Networking and How the Internet Works" by Douglas E. Comer

ELECTIVE I - BCA & B.Sc Cs III Semester

Course Code: 24BCAEL32/ 24BScEL32	E-Commerce
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	hours
Unit-1: E-Commerce and Online Shopping: E-commerce structure, Popular online shopping websites, Safe online shopping practices. Distinction between E-commerce and E-business. Benefits and limitations of E-commerce. E-commerce Business Models: Business-to-Consumer (B2C), Business-to-Business (B2B), Consumer-to-Consumer (C2C), Consumer-to-Business (C2B), Government-to-Citizen (G2C), Government-to-Business (G2B), etc., Emerging models.	8
Unit-2: E-commerce Platforms and Solutions: Types of e-commerce platforms (SaaS, open-source, custom-built). Popular platforms (Shopify, WooCommerce, Magento, BigCommerce). Features and considerations for choosing a platform Building an E-Commerce Website, Building an E-commerce Presence: Website design principles for e-commerce (UX/UI, mobile responsiveness). Content Management Systems (CMS) in e-commerce.	8
Unit-3: Digital Marketing Strategies: Search Engine Optimization (SEO) for e-commerce. Search Engine Marketing (SEM) - Paid advertising (Google Ads). Social Media Marketing (SMM) and social commerce. Email Marketing and customer relationship management (CRM). Content Marketing for e-commerce. Affiliate Marketing.	8
Unit-4: E-Commerce Security: Common security threats (phishing, malware, DDoS attacks, data breaches). Security measures (SSL/TLS, firewalls, encryption). Digital certificates and authentication. Anti-virus, and Anti-malware, Data Protection and Privacy Intellectual Property Rights (IPR) .	8

References:

1. Kenneth C. Laudon, Carol Guercio Traver - E-Commerce, Pearson, 10th Edition, 2016
2. Laudon, K. C., & Traver, C. G. (Latest Edition). *E-commerce: Business. Technology. Society.* Pearson.

ELECTIVE II – BCA IV Semester

Course Code: 24BCAEL41	Software Testing
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 36	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	hours
Unit-1: Fundamentals of Software Testing: Definition, purpose, and importance of testing, Goals of testing (finding defects, preventing defects, gaining confidence, providing information). Debugging vs. Testing. Quality Assurance (QA), Quality Control (QC), Seven Principles of Testing-Testing shows presence of defects, not absence, Exhaustive testing is impossible, Early testing, Defect clustering, Pesticide paradox, Testing is context dependent, Absence of errors fallacy.	8
Unit-2: Software Development Life Cycle (SDLC) Overview of common SDLC models (Waterfall, V-Model, Iterative, Agile, DevOps), Role of testing in different SDLC models, Software Testing Life Cycle (STLC)-Phases: Test Techniques Overview: Black-Box Testing Techniques: Equivalence Partitioning, Boundary Value Analysis (BVA), Decision Table Testing, State Transition Testing, Use Case Testing White-Box Testing Techniques: Statement Coverage, Decision Coverage, Path Testing, Loop Testing.	8
Unit-3: Acceptance Testing (User Acceptance Testing - UAT, Alpha, Beta), Test Types: Functional Testing- Smoke Testing, Sanity Testing, Regression Testing, Re-testing, Localization Testing, Globalization Testing, Usability Testing, Non-Functional Testing- Performance Testing (Load, Stress, Endurance, Spike), Security Testing, Compatibility Testing, Reliability Testing, Maintainability Testing, Portability Testing.	8
Unit- 4: Maintenance Testing: Impact Analysis, Regression Testing, Automation: Selenium WebDriver Basics, Selenium Suite (IDE, RC, WebDriver, Grid). Selenium Architecture, Automation Frameworks- Robot Framework, Cypress, Appium, Configuration Management Tools -Git, SVN.	8

References:

1. "Foundations of Software Testing ISTQB Certification" by Dorothy Graham, Rex Black, Erik van Veenendaal.
2. "Introduction to Software Testing" by Paul Ammann and Jeff Offutt.

ELECTIVE II – BCA IV Semester

Course Code: 24BCAEL42	Digital Image Processing
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	hours
Unit-1: Digital Image Processing: Definition, advantages, Applications. Image Sensing and Acquisition: Image formation model, image capturing devices (cameras, scanners). Image Sampling and Quantization: Spatial resolution, intensity resolution, aliasing, staircase effect. Basic Concepts in Digital Images: Pixels, intensity levels, grayscale images, color images (RGB, CMYK, HSV models).	8
Unit-2: Basic Relationships Between Pixels: Neighbors, Adjacency, Connectivity, Paths, Distance Measures. Image File Formats: BMP, JPEG, PNG, GIF, TIFF Image Restoration and Reconstruction: Model of image degradation, noise models Noise Filters: Mean filters, Median filter, Max/Min filter	8
Unit-3: Image Compression: Redundancy (coding, interpixel, psychovisual), fidelity criteria. Compression Models: Source encoder, channel encoder. Image Segmentation, Representation: Point, Line, and Edge Detection (Sobel, Canny edge detector).	8
Unit – 4: Image Segmentation Methods: Thresholding methods: global, adaptive, Otsu's method Edge-based segmentation: Canny, Sobel, Laplacian Region-Based Segmentation: Region growing, region splitting and merging. Clustering methods: K-Means, Mean Shift Morphological operations: Dilation, Erosion, Opening, Closing	8

References:

1. **"Digital Image Processing"** by Rafael C. Gonzalez and Richard E. Woods (Pearson) - *The foundational and most widely used textbook. Essential reference for almost every unit.*
2. **"Digital Image Processing using MATLAB"** by Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins (Pearson) .

Fourth Semester - **COMPULSORY 1 (Practical Knowledge/Skill)**

Course Code: 24BCAC1	Blockchain Technology
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment: 10
Exam Duration: 02	Semester end Exam Marks: 40

Contents	hours
Unit-1 : Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.	8
Unit-2 : Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys.	8
Unit-3 : Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash.	8
Unit-4 : Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	8

References:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017.
2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016.
3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017.

Fifth Semester: COMPULSORY 2

24BCA6C2: MOOCs / Industry Internship

The students shall take up MOOCs in Computer Science (SWAYAM / NPTEL / Coursera / edX, etc.) or Industry Internship with minimum of eight weeks during fifth semester. The students shall initiate to choose either MOOCs or Industry Internship after the fourth semester examination (semester break). The students have to contact the allotted guide while selecting the MOOCs course/while selecting the organization for Internship. In the end of fifth semester, the students have to submit the report with the consent from the allotted guide for external evaluation.

Project/Industry Internship/MOOCs - Examination

Sl. No.	Component	Maximum Marks
01	Certificate/Dissertation/ Report	30
02	Viva Voice/Presentation	10
TOTAL MARKS		40

SIXTH SEMESTER – COMPULSORY 3

Course Code: 24BCA6C3	Mobile Application Development
Course Credits: 02	Teaching Hours per Week: 02
Total Contact Hours: 32	Internal Assessment : 10
Exam Duration: 03	Semester end Exam Marks: 40

Contents	hours
Unit-1 : Introduction to Mobile Ecosystems : Mobile Landscape: Types of Mobile Apps (Native, Web, Hybrid), Mobile OS Overview (Android vs. iOS), and Market Trends. Cross-Platform Frameworks :Flutter (by Google):using Dart. React Native (by Meta) using JavaScript / TypeScript.	10
Unit-2 : Android basics. Android Architecture: The Linux Kernel, Libraries, Android Runtime (ART), and the Application Framework. Development Environment: Setting up Android Studio, Project Structure: AndroidManifest.xml, Gradle scripts, and the res (resources) folder. Activity Life Cycle: The core states of a mobile app—onCreate(), onStart(), onResume(), onPause(), onStop(), and onDestroy().	10
Unit-3: User Interface (UI) Design & Event Handling Layouts: ConstraintLayout, LinearLayout, RelativeLayout, and FrameLayout. UI Widgets: TextView, EditText, Buttons, Checkboxes, Radio Buttons, and ImageViews. Adapters & Lists: RecyclerView and ListView. Event Handling: user input (clicks, long presses, and swipes). Menus & Navigation: Options menus, Contextual menus, and the Navigation Drawer.	12

References

- 1.Android Programming The Big Nerd Ranch Guide by Bill Phillips
- 2.Head First Android Development by Dawn Griffiths
- 3.Kotlin for Android Developers by Antonio Leiva.

THEORY EXAMINATION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS

(Semesters I –VI)

B.C.A Semester-I Degree Examination; 2024-25

(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: COMPUTER SCIENCE

Paper – _____: _____

Paper Code: _____

Time: 3 Hours

Max. Marks: 80

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

1. Answer *all* the following questions:

(2×10=20)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

SECTION-B

Answer any *SIX* of the following: (Two Questions From each Unit)

(5×6=30)

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

SECTION -C

Answer *Any Three* of the following:

(10×3=30)

10.

From Unit-I

11.

From Unit-II

12.

From Unit-III

13.

From Unit-IV

THEORY EXAMINATION QUESTION PAPER PATTERN FOR ELECTIVE/OPTIONAL PAPERS

(Semesters III & IV)

B.Sc./BCA Semester-I/II/III/IV/V Degree Examination; 2024-25

(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: COMPUTER SCIENCE

Paper – ELECTIVE/OPTIONAL III & IV _____: _____

Paper Code: _____

Time: 2 Hours

Max. Marks: 40

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

Answer **all** the following questions:

(2×5=10)

- 1.
- 2.
- 3.
- 4.
- 5.

SECTION-B

Answer any **SIX** of the following:

(5×6=30)

- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

Syllabus Distribution for Question Paper Setting		
Section-A	Ten Questions of each carrying 02 marks	Two questions each from unit-1 and Unit-2. And Three questions each from Unit-3 and unit-4.
Section -B	Eight Questions carrying 06 marks each.	Two questions from each unit.
Section -C	Four Questions carrying 10 marks each	One question from each unit. (There shall be sub-Questions.)