Karmaveer Bhaurao Patil University, Satara

Syllabus for
B. Sc. II Computer Science (Entire)

Under
Faculty of Science and Technology
(As per NEP 2020)

With effect from Academic Year 2025-2026

Preamble:

There are bright career prospects for computer science professionals or software professionals in recent scenario. With the opening of huge software and IT companies in India, the job opportunities for trained professionals have increased considerably. India is known to be a leader in software and IT sector.

Computer science graduates pass outs find job opportunities in a variety of environments in academia, research, industry, government, private, business organizations and so on.

They are involved in analyzing problems for solutions, formulating and testing, using advanced communications or multi-media equipment, or working in teams for product development.

The software and IT companies are the major employers of computer science graduates. They offer the best packages to the young graduates which are unmatched with other branches of science.

General Objectives of the Program:

1. To nurture academicians with focus and commitment to their subject.
2. To shape good and informed citizens from the students entering into the Programme.
3. To create a skilled workforce to match the requirements of the society.
4. To impart knowledge of Science is the basic objective of this Programme.
5. To develop scientific attitude is the major objective so as to make the students open minded, critical and curious.
6. To develop skill in practical work, experiments and laboratory materials and equipments

Programme Outcomes:

Along with the collection and interpretation of scientific data to contribute to science.

1. The students will graduate with proficiency in the subject of their choice.
2. The students will be eligible to continue higher studies in their subject.
3. The students will be eligible to pursue higher studies abroad.
4. The students will be eligible to appear for the examinations for jobs in government organizations.
5. The students will be eligible to apply for jobs with a minimum requirement of B.Sc. Programme.

Program Specific Objectives of the Course:

1. The content of the syllabus have been framed as per UGC norms of CBCS Pattern.
2. The students are expected to understand the fundamentals, principles, mathematical, recent IT concepts and recent developments in the subject area.
3. The practical course is in relevance to the theory courses to improve the understanding of the concepts.
4. It is expected to inspire and boost interest of the students towards Computer Science as the main subject.
5. To develop the power of appreciations, the achievements in Computer and role in nature and society.
6. To enhance student sense of enthusiasm towards IT and to involve them in an intellectually stimulating experience of learning in a supportive environment.

Program Specific Outcomes:

After successful completion of B.Sc. Computer Science (Entire) Course student will be able to:

1. Understand the basics of Computer Science.
2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Computer Science.
4. Identify their area of interest in academic, research and development.
5. Perform job in various fields' like IT, science, engineering, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought, expression, and systematic approach

1. TITLE: Computer Science (Entire)

2. YEAR OF IMPLEMENTATION: **2025-2026**

3. DURATION: **01 year**

4. PATTERN: **Semester examination**

5. MEDIUM OF INSTRUCTION: **English**

6. STRUCTURE OF COURSE:

As per NEP (2.0)

Sem(Level)	**Subject**			**OE**	**VSC/SEC**	**AEC /VEC/IKS**	**OJT/ FP/CEP/CC/RP**	**Total**	**Degree/Com cr. MEME**
	Course I	**Course II**	**Course III**						
	Major	**Minor**							
Sem III (5.0)	Major V(2) Major VI(2) Major P III(2)	Minor V(2) Minor VI(2) Minor P III(2)		OE3 (2) (T+P)	VSC1 (2) (P) (Major Specific) SEC 1(2) (T+P)	AEC 1 (2) (English) IKS 2(2) (Major Specific)		22	UG Diploma
Sem IV (5.0)	Major VII(2) Major VIII(2) Major P IV (2)	Minor VII(2) Minor VIII(2) Minor P III(2)		OE4 (2) (T+P)	VSC2 (2) (P) (Major Specific) SEC 2(2) (T+P)	AEC 2 (2) (English) VEC 2(2) (Environmental Studies)		22	
Credit	12	12		4	8	8		44	Exit Option 4 cr. NSQ/Intership/Skill Courses

7. COURSE TITLE

Structure and Titles of B.Sc. II Course:

SEM - III

Sr.no	Course Category		Name of Course	Credits
1	Course -I (Major)	BCSET 231	Data Structure using C	2
2		BCSET 232	Cloud Computing	2
3		BCSEP 233	Lab based on BCSET 231 & BCSET 232	2
4	Course-II (Minor)	BCSET 234	Web Multimedia -I	2
5		BCSET 235	Basic JavaScript	2
6		BCSEP 236	Lab based on BCSET 234 & BCSET 235	2
7	VSC	BCSETVSC I	Data Analytics-I	2
8	SEC (T)	BCSETSEC I	Operating System	1
9	SEC (P)	BCSEPSEC I	Lab based on BCSET SEC 1	1
10	AEC	BCSETAEC I	English	2
11	OE	BCSET OE III	OE 3	2
12	IKS	BCSETIKS II	History of Computers in India	2

SEM - IV

Sr.no	Course Category		Name of Course	Credits
1	Course -I (Major)	BCSET 241	Object Oriented Programming using C++	2
2		BCSET 242	Cyber Security Concepts	2
3		BCSEP 243	Lab based on BCSET 241 & BCSET 242	2
4	Course-II (Minor)	BCSET244	Web Multimedia II	2
5		BCSET 245	Computer Networks	2
6		BCSEP 246	Lab based on BCSET 244 & BCSET 245	2
7	VSC	BCSETVSC II	Data Analytics -II	2
8	SEC (T)	BCSETSECII	Linux Operating System	1
9	SEC (P)	BCSEPSEC II	Lab based on BCSETSEC 2	1
10	AEC	BCSETAEC II	English	2
11	OE	BCSET OE IV	OE 4	2
12	VEC	BCSET VEC II	Environmental Awareness for Computer Science	2

8. EVALUATION STRUCTURE:

- **B.Sc. II NEP 2.0**
  - Semester III (5.0)

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	Mid - Semester	CCE-II			
Course I (Major)	T	BCSET 231	05	10	05	30	50	02
	T	BCSET 232	05	10	05	30	50	02
	P	BCSEP 233	--	--	--	50	50	02
Course II (Minor)	T	BCSET 234	05	10	05	30	50	02
	T	BCSET 235	05	10	05	30	50	02
	P	BCSEP 236	--	--	--	50	50	02
OE	T	BCSETOE III	05	--	05	15	25	01
	P	BCSEPOE III	--	--	--	25	25	01
VSC	P	BCSEPVSC I	--	--	--	50	50	02
SEC 1	T	BCSETSEC I	05	--	05	15	25	01
	P	BCSEPSEC I	--	--	--	25	25	01
AEC 1	T	BCSETAEC I	05	10	05	30	50	02
IKS 2	T	BCSETIKS II	05	10	05	30	50	02
Total							**550**	**22**

- **Semester IV**

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	Mid - Semester	CCE-II			
Course I	T	BCSET 241	05	10	05	30	50	02
	T	BCSET 242	05	10	05	30	50	02
	P	BCSEP 243	--	--	--	50	50	02
Course II	T	BCSET 244	05	10	05	30	50	02
	T	BCSET 245	05	10	05	30	50	02
	P	BCSEP 246	--	--	--	50	50	02
OE	T	BCSETOE IV	05	--	05	15	25	01
	P	BCSEPOE IV	--	--	--	25	25	01
VSC	P	BCSEPVSC II	--	--	--	50	50	02
SEC	T	BCSETSEC II Theory	05	--	05	15	25	01
	P	BCSEPSEC II Practical	--	--	--	25	25	01
AEC II	T	BCSETAEC II	05	10	05	30	50	02
VEC II	T	BCSETVEC II	05	10	05	30	50	02
Total							**550**	**22**

9. OTHER FEATURES:

A) LIBRARY:

Reference books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENT:

a) Computers, LCD projector, Laptops, smart Screen board

b) Laboratory Equipment:

1. Computers
2. Printers
3. Scanners
4. LAN Connection
5. LCD Projecctor

B.Sc. Part II, Semester III

BCSET 231: Data Structure Using C

(Total Credits – 2)

Course objectives: Student should be able to…

1. study the concept of Data Structure
2. understand the Searching and Sorting Methods
3. discuss the Concept of Stack and Queue.
4. acquire knowledge of Linked list and trees

Units	Content	No. of hours
I	**Basics of Data Structure** Data Structure: Need of data structure ,Linear and non-linear, classification of data structure, operations on data structure:Traversing,Inserting,Deleting,Searching,Sorting,Merging different approaches to designing an algorithm: top-down, bottom-up Performance analysis: time complexity and space complexity, Big 'O'Notation Sorting techniques: Introduction, selection sort, insertion sort, bubble sort, merge sort, quick sort Searching: Linear search ,Binary search	8
II	**Stack and Queue** Introduction to stack: stack as abstract data type, representation of stack through arrays, Applications of stack: reversing a list, conversion of infix to postfix, evaluation of postfix, converting an infix into prefix, evaluation of prefix expression, recursion Introduction: Queue as ADT, representation of queue as an array Types of queue: circular queue, double ended queue, priority queue, dequeue, Applications of queue.	8
III	**Linked List & Tree** Introduction:Terminologies:node,address,pointer,information,next,null pointer, empty list etc Types of list: linear ,circular, doubly list Operations on linked list: searching, inserting, deleting Trees terminologies, types of trees	7
IV	**Graph** Graph-introduction, terminologies, representation of a graph Traversal of graph: Depth-first search (DFS),Breadth-first Search (BFS),Applications of graph, Hashing: Hash function collision resolution technique.	**7**

Course Outcome: Student will be able to….

1. demonstrate an understanding of fundamental data structures
2. analyze and compare various sorting and searching algorithms
3. design and implement different types of linked lists
4. develop and apply stack and queue data structures

References:

1. Data structure using C++ , 2010, D.S. Malik , Course Technology ,Second Edition ISBN 978-0324782011
2. Data Structure Through C++,2003, Yashwant Kanitkat, BPB Publication, Second Edition ISBN 978-8176561450
3. "Data Structures Using C" by Aaron M. Tenenbaum, Yedidyah Langsam, and Moshe J. Augenstein ISBN 978-0130224184
4. "Data Structures and Algorithms Made Easy in C" by Narasimha Karumanchi ISBN 978-8193245277
5. "Data Structures and Algorithm Analysis in C" by Mark Allen Weiss ISBN 978-0201361186
6. “Cloud Computing: Concepts, Technology & Architecture”, 2013. Ricardo Puttini, Zaigham Mahmood, Thomas Erl, Prentice Hall. ISBN 978-0133387520
7. “Cloud Computing For Dummies”, 2009.by Judith Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper.ISBN 978-0470546590
8. “Cloud Computing: From Beginning to End” ,2015., Ray Rafaels, Createspace Independent Publishing Platform, ISBN 978-1511404587

B.Sc. Part II, Semester III
BCSET 232: Cloud Computing
(Total Credit 2)

Course Objectives: Student will be able to….

1. understand the concepts of Cloud Computing.
2. study Taxonomy of Virtualization Techniques.
3. imbibe Cloud Computing Architecture.
4. acquire knowledge on Aneka Cloud Application Platform.

Unit	Content	No. of hours
I	**Cloud Computing Fundamentals** Definition, Types of Clouds, Motivation for Cloud Computing, The Need for Cloud Computing, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models Comparing cloud providers with traditional IT service providers	**8**
II	**Cloud Computing Architecture and Management** Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Types of cloud, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.	**7**
III	**Cloud Infrastructure and Computing** Infrastructure as a Service, Platform as a Service, Software as a Service, types of computing :High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.	**7**
IV	**Cloud Service Providers** Captiva Cloud Toolkit, Google, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform	**8**

Course Outcomes: Student will be able to….

1) implement the concept of virtualization and how this has enabled the development of Cloud Computing

2) apply the fundamentals of cloud, cloud Architectures and types of services in cloud

3) design different Applications in cloud

4) explore some important cloud computing driven commercial systems

References:

1.Kogent Learning Solutions Inc. 2012. HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery. New Delhi: Dreamtech Press.ISBN 978-9351199078

2.Xavier, C. 2012. Web Technology and Design. New Delhi: New Age International Publishers.ISBN 978-8122414509

3.Gopalan, N. P., and J. Akilandeswari. 2014. Web Technology: A Developer's Perspective. New Delhi: PHI Learning.ISBN 978-8120350069

4.Deshpande, D. M. 2015. Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET. Pune: Dreamtech Press.ISBN 978-8177229974

5.Mohtashim, Syed. 2017. HTML, CSS, JavaScript, Perl, Python and PHP. New Delhi: BPB Publications.ISBN 978-8126506200

B.Sc. Part II, Semester III
BCSEP-233: Lab Course Based on BCSET 231 & BCSET 232
(Total Credits 2)

Course Objectives: Student will be able to….

1. study the concept of Data Structure
2. understand the Searching and Sorting Methods
3. acquire the Concept of Stack and Queue.
4. know the Cloud Applications.

	Practicals	
	Group A-BCSET 231 1.Write C programs to implement Search Algorithms .Linear Search , II.Binary Search. 2.Write C programs to implement Sorting Algorithms Selection Sort, Insertion Sort, Bubble Sort. 3.Write C programs to implement Sorting Algorithms Merge Sort , Quick Sort. 4.Write C programs to perform Stack Operations using Array Implement Stack using Array,Access Element from Stack,Check if Stack is Empty 5.. Write C programs to Implement Queue using Array 6.Write C programs to perform Singly Linked List - Basic Operations · Insert an Element **7.**Write C program to Binary Search Tree (BST) - Operations I.Insert Element into BST II.Delete Element from BST III.Search Key Element in BST 8.Write C program to Graph Traversals - Part 1 Implement BFS (Breadth-First Search) 9.Write C program to Graph Traversals - Part 2 Implement DFS (Depth-First Search) 10. Practice combining multiple data structures (e.g., stack + recursion, linked list in BFS/DFS) **Group B -BCSET 232** 11.To discuss the process of choosing the right cloud deployment model for a startup 12.To perform the migration of a traditional web application to a cloud environment 13.To compare IaaS, PaaS, and SaaS models for developing and running a business application 14.To implement basic cloud services using AWS (Amazon Web Services) 15.To explore high-performance and grid computing for scientific research using cloud resources 16.To develop and host a cloud-based mobile application using Google	

	Cloud services 17.To study the use of SAP HANA Cloud Platform for Enterprise Resource Planning (ERP) 18.To manage and monitor cloud infrastructure using Microsoft Azure 19.To use Salesforce as a SaaS tool for Customer Relationship Management (CRM) 20.To discuss future computing paradigms in the cloud such as edge computing, serverless, and quantum computing	

Course Outcomes: Student will be able to …..

1. apply basic aspects of data structures including Stacks, Queue, Linked list and Tree.
2. different sorting and searching algorithms,Implementations of linked list.
3. implementations of stack and queue
4. use vmware.
5. create a cloud.

References:

1. Data structure using C++ ,D.S. Malik , Course Technology ,Second Edition2010 ISBN 9780324782011
2. Data Structure Through C++, Yashwant Kanitkat, BPB Publication, Second Edition 2003 ISBN 9788176566209
3. "Data Structures Using C" by Aaron M. Tenenbaum, Yedidyah Langsam, and Moshe J. Augenstein ISBN 9780130224184
4. "Data Structures and Algorithms Made Easy in C" by Narasimha Karumanchi ISBN 9788193245277
5. "Data Structures and Algorithm Analysis in C" by Mark Allen Weiss ISBN 9780201361186
6. “Cloud Computing: Concepts, Technology & Architecture”,Ricardo Puttini, Zaigham Mahmood, Thomas Erl, Prentice Hall, 2013. ISBN 9780201361186
7. “Cloud Computing For Dummies”, by Judith Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper was published in 2009. ISBN 9780201361186
8. “Cloud Computing: From Beginning to End”, Ray Rafaels, Createspace Independent Publishing Platform, 2015. ISBN 9780201361186

B.Sc. Part II, Semester III

BCSET234: Web Multimedia

(Total Credit 2)

Course Objectives: Student will be able to…

1. understand basics of Internet and World Wide Web.
2. study Various HTML tags.
3. know HTML linking with multimedia.
4. introduction of CSS &Style Sheets to Create Web pages.

Units	Content	No. of hours
I	**Basics of Internet and Web Designing** Internet, HTTP and HTTPS, Website, Dynamic and Static Website, Five golden rule in web design, Web page Design, Basic Principle Involved in Developing a web. Planning process, site map, web layout.	**7**
II	**HTML concepts** Basic structure of HTML, Fundamental Elements of HTML, Advantages and Disadvantages of HTML. Basic HTML Tags, Text Formatting Tags and List Tags HTML Tables:- Table Heading, Cell padding and Cell spacing Attributes, Colspan and Rowspan HTML List:- Unordered List, Ordered Lists, type Attribute	8
III	**HTML Linking and HTML Embedding Multimedia** HTML Text Link:- Linking Documents, target Attribute, Use of Base Path, Linking to a Page Section, Setting Link Colors, working with image, Display alternate text on image HTML Email Link:- HTML Email Tag, aligning an image, using image link, What is multimedia, working with multimedia file using object tag to insert object.	8
IV	**Unit 4 : Cascading Style Sheets** Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts)Working With Block Element and Objects, Working with list and Tables, CSS ID and Class Box Model(Introduction, Border Properties, Padding Properties, Margin Properties)CSS Color, Creating Page layout and Site Design.	7

Course Outcomes: Student will be able to …..

1. analyze a web page
2. identify its elements and attributes.
3. create web pages using HTML and its various Tags.
4. use relationship of HTML and CSS.

References:

1.Kogent Learning Solutions Inc. 2012. HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery. New Delhi: Dreamtech Press.ISBN 9789351199078

2.Xavier, C. 2012. Web Technology and Design. New Delhi: New Age International Publishers.ISBN 978-8122414509

3.Gopalan, N. P., and J. Akilandeswari. 2014. Web Technology: A Developer's Perspective. New Delhi: PHI Learning.ISBN 978-8120350069

4.Deshpande, D. M. 2015. Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET. Pune: Dreamtech Press.ISBN 978-8177229974

5.Bhatia, Puneet. 2017. Web Designing and Development: Concepts and Techniques. New Delhi: Ignou Publications.ISBN 978-9332587373

6.Mohtashim, Syed. 2017. HTML, CSS, JavaScript, Perl, Python and PHP. New Delhi: BPB Publications.ISBN 978-0764588204

B.Sc. Part II, Semester III

BCSET235: Basic JavaScript

(Total Credit 2)

Course Objectives: Student will be able to …..

1. explain the role of JavaScript in web development and understand basic concepts
2. access and modify HTML elements dynamically using JavaScript
3. define and call functions, handle user interactions using event listeners.
4. study techniques, use browser developer tools, and write error-free, efficient code through testing and iteration.

Units	Content	No. of hours
I	**JavaScript Fundamentals** Definition, Basic syntax ,Variables and Data Types: Declaring variables using var, let, and const, Data types – string, number, boolean, array, object null, undefined, Control Flow: Conditional statements (if, else, switch), Loops (for, while, do...while), Logical operators (&&, ||, !).	7
II	**Arrays and Objects** To create, manipulate, and iterate arrays and objects, Arrays: Creating arrays, Adding/removing elements, Accessing and iterating over array elements, common array methods like push(), pop(), splice(), map(), filter(),Objects: Creating and using JavaScript objects, Understanding obje properties and methods, Object-Oriented Programming Concepts: Introduction to OOP in JavaScript, Use of this keyword, Method definitio inside objects	8
III	**Functions and Scope** Functions: Declaring and calling functions, Passing parameters, Returning value, Scope: Global scope, Local scope, Block scope using let and const., Closures: Definition and real-life examples of closures, Use cases in function factories and data privacy.	8
IV	**DOM Manipulation and Event Handling** Introduction to DOM: the structure of a webpage (DOM tree), Accessing DOM elements using getElementById, querySelector, etc. Modifying DOM Elements: Changing content (innerHTML), styles (style property), and attributes (setAttribute),Event Handling: Adding event listeners, Handling common events like click, mouseover, input, Using the event object, Basic form validation using JavaScript	7

Course Outcomes: Student will be able to…

1. use JavaScript syntax, variables, and control structures.
2. manipulate arrays and objects using built-in methods.

3. apply functions, scope rules, and closures effectively.
4. handle DOM manipulation and events for interactivity.

References:

1. Shah, Rushabh Mulraj. *Decoding JavaScript: A Simple Guide for the Not-so-Simple JavaScript Concepts, Libraries, Tools, and Frameworks*. New Delhi: BPB Publications, May 2021. ISBN 13 978-9390684816.
2. Belov, Yanko. *JavaScript Masterclass*. New Delhi: BPB Publications, 2024. ISBN 978-9355517074.
3. Kogent Learning Solutions Inc., *HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery* (New Delhi: Dreamtech Press, 2012), 121.ISBN 978-9351199078
4. Lemay, Laura. *Mastering HTML, CSS & JavaScript Web Publishing*. New Delhi: BPB Publications, 2016. ISBN 978-8183335157.
5. Atul Kahate Sharma, *Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax* (Mumbai: Tech-Max Publications, 2018), 42.ISBN 978-1259062681
6. Ramesh Bangia Shukla, *Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax* (New Delhi: Firewall Media, 2015), 88.ISBN 978-8131805527

B.Sc. Part II, Semester III

BCSEP-236 Lab Course based on BCSET 233 &BCSET 234

(Total Credit 2)

Course Objectives: Student will be able to …..

1. understand basics of Internet and World Wide Web.
2. study Various HTML tags.
3. state CSS &Style Sheets to Create Web pages.
4. deliver JavaScript Fundamentals, Interactivity in Web Pages

	Practicals	
	Group A- BCSET 233 1 To create the basic structure of a webpage using HTML 2.To design and implement forms in HTML 3.To apply inline and basic CSS styling to HTML elements 4.To perform text styling and use different fonts using CSS 5.To design a simple navigation menu using HTML and CSS 6.To apply backgrounds and manage page layout using CSS 7.To use CSS hover effects and transitions for interactive elements 8.To design a responsive webpage layout using media queries 9.To embed multimedia content like audio, video, and images in a webpage 10.To create tables in HTML and position elements using CSS **Group B- BCSET 234** 11.To create a basic HTML page and write a simple JavaScript program using alert() and console.log() to display messages. 12.To declare variables using var, let, and const, and demonstrate different data types such as string, number, boolean, null, undefined, array, and object using typeof operator. 13.To create a JavaScript program that uses if, else if, else, and switch statements to check age groups or grade ranges. 14.To demonstrate the use of for, while, and do...while loops and use of logical operators (&&, ||, !) in conditions. 15.To create an array of numbers, add/remove elements, and use methods like push(), pop(), splice(), map(), and filter() for array operations. 16.To create a JavaScript object with properties and methods and access them using dot notation and bracket notation. 17.To define an object with methods using the this keyword and show basic object-oriented behavior in JavaScript..	

	18.To declare functions with parameters and return values, and demonstrate scope using var, let, and const. 19.To create a closure and explain how inner functions maintain access to the outer function's variables even after the outer function has executed. 20.To access and modify HTML elements using JavaScript, add event listeners for user interaction (like click and input), and perform basic form validation.	

Course Outcomes: Student will be able to…

1. analyze a web page
2. identify its elements and attributes.
3. create web pages using HTML and its various Tags.
4. apply JavaScript syntax, variables, and control structures.

References:

1.Kogent Learning Solutions Inc. 2012. HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery. New Delhi: Dreamtech Press.ISBN 978-9351199078

2.Xavier, C. 2012. Web Technology and Design. New Delhi: New Age International Publishers.ISBN 978-8122414509

3.Gopalan, N. P., and J. Akilandeswari. 2014. Web Technology: A Developer's Perspective. New Delhi: PHI Learning.ISBN 978-8120350069

4.Deshpande, D. M. 2015. Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET. Pune: Dreamtech Press.ISBN 978-8177229974

5.Mohtashim, Syed.HTML, CSS, JavaScript, Perl, Python and PHP.New Delhi: BPB Publications, 2017. ISBN 9788183335560.

6.Sinha, Abhilasha, Ranjit Battewad, and Alok Ranjan.JavaScript for Modern Web Development: From HTML to React-Redux.New Delhi: BPB Publications, 2020. ISBN 9789389328721.

B.Sc. Part II, Semester III

BCSEPVSC 1: Data Analytics-I

(Total Credit 2)

Course Objectives: Student will be able to…

1. understands the basics of MATLAB.
2. perform mathematical operations efficiently using MATLAB's array-based approach.
3. learn the fundamental concepts of programming with R.
4. discuss data structures in R and their manipulation.

	Practical	
	Group -A(Using Matlab) 1. Program to create vectors and matrices by using matlab. 2. Program to create Array Indexing and modification by using matlab. 3. Mathematical Expressions with symbolic variables by using matlab. 4. Program to Define and solve symbolic equation by using matlab. 5. Algebraic manipulation and simplificaton by using matlab. 6. Symbolic function in matlab. 7. Visualize symbolic function and equation by using matlab. 8. Numeric data type in matlab. 9. Calculus with symbolic maths by using matlab. 10. To solve a system of linear equations using MATLAB by applying matrix operations. **Group -B (Using R)** 11. Program to create Vector using R. 12. Program to implement Arithmetic operator using R. 13. Program to implement logical operator using R. 14. Program to create Barplot, Histogram using R. 15. Program to create ogive curve using R. 16. Program to create frequency polygon, pie chart using R. 17. Program to create Matrix. 18. Program to create Array. 19. Program to create list. 20. Program to create data frame.	

Course Outcomes: Student will be able to…

1. apply different data types and structures in MATLAB.
2. utilize conditional data selection techniques to extract relevant information.
3. demonstrate proficiency in programming in the R language.
4. manipulate and analyze data effectively using R.

Reference Books:

Matlab:

1. Rudra Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers (New Delhi: Oxford University Press, 2020), 112.ISBN 978-0190602062
2. Shailendra Jain, Modeling and Simulation Using MATLAB - Simulink (New Delhi: PHI Learning, 2016), 88. ISBN 978-8126555949
3. Agam Kumar Tyagi, MATLAB and Simulink for Engineers (New Delhi: University Science Press, 2011), 143. ISBN 978-0198072447
4. K. Subramanian, MATLAB: An Introduction with Applications (Chennai: Oxford University Press, 2015), 99. ISBN 978-1119385134
5. Bansal, R.K., MATLAB and Its Applications in Engineering (New Delhi: Laxmi Publications, 2018), 77. ISBN 978-9332542099
6. MATLAB and Simulink for Engineers.New Delhi: Oxford University Press, 2011. ISBN 9780198072447.

R Software:

1. Pawgi, Vishwas R.*Statistical Computing Using R Software.*Maharashtra: Nirali Prakashan, 2022. ISBN 9789354517372.
2. Athar Jamal and Jiteshree Raut, Statistics with R Programming (Maharashtra: Digilearning Tech Pvt. Ltd., 2024), 57. ISBN 978-8197682254
3. Vishwas R. Pawgi, Statistical Computing Using R Software (Maharashtra: Nirali Prakashan, 2022), 33.ISBN 978-9354517372
4. K.G. Srinivasa, Statistical Programming in R (New Delhi: Oxford University Press, 2018), 88.ISBN 978-0199480357
5. Tilman M. Davies, The Book of R: A First Course in Programming and Statistics (California: No Starch Press, 2016), 101.ISBN 978-1593276281
6. Garrett Grolemund, Hands-On Programming with R (California: O'Reilly Media, 2014), 76.ISBN 978-1449359010
7. Norman Matloff, The Art of R Programming (California: No Starch Press, 2011), 129.ISBN 978-1593273842
8. John Chambers, Software for Data Analysis: Programming with R (New York: Springer, 2008), 54.ISBN 978-0387954570

B.Sc. Part II , Semester III

BCSETSEC-1: Operating System

(Total Credit 2)

Course Objectives: Student will be able to…

1. aware of different types of Operating System and their services.
2. learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. understand Memory management Concepts
4. study Deadlock and Concurrency concepts.

Unit	Content	No. of hours
I	**Basic concepts of Operating Systems** Introduction and Definition of operating system, Types of Operating System, Operating system Services, Simple monitor, buffering, spooling, Protection: I/O, Memory, CPU protection, System calls: types of system call, system call implementation, System programs, Interrupts in operating system	7
II	**Scheduling concept** Process Concept – The process, Process states, Scheduling concept-- Scheduling queues, CPU scheduler, Scheduling criteria (Terminologies used in scheduling),Scheduling algorithms (FCFS, SJF, Priority, Round Robin, Multiple queue, multilevel feedback queue)Disk scheduling: FCFS, Shortest seek time first, Scan, C-Scan, Look, C Look	8
III	**Memory Management & File System** Memory Management: Relocation, Swapping, Overlapping, Partitioning and Segmentation Paging: Page overlaps, demand paging, Page replacement algorithm (FIFO, Optimal, and LRU), virtual memory, File concept, directory structure (Single level, two level, Tree structure, acyclic graph, General graph directory) Access Methods--Sequential, DirectAllocation Methods – Contiguous allocation, Linked allocation, Indexed allocation	8
IV	**Deadlocks & Concurrent processing** Deadlock Characterization – Necessary conditions, Resource allocation graph ,Deadlock Prevention, Deadlock Avoidance - Safe state, Banker's Algorithm , Deadlock Detection, Recovery from Deadlock – Process termination, Resource pre-emption, Concurrent processing: Precedence Graph, fork and join, Semaphore	7

Course Outcomes: Student will be able to…

1. use the different services provided by Operating System at different level.
2. design real life applications of Operating System in every field.
3. execute different process scheduling algorithm and synchronization techniques to avoid

deadlock.

4. develop different memory management techniques like paging, segmentation and demand paging etc.

Reference books:

1.Godbole, A. S., and Kailash Pathak. 2014. Operating Systems. 3rd ed. New Delhi: Tata McGraw-Hill Publishing Company.ISBN 978-0070702035

2.Dhamdhere, D. M.*Operating Systems: A Concept-Based Approach.* 3rd ed. New Delhi: McGraw-Hill Education, 2017. ISBN 9781259005589.

3.Rajiv, Chopra. 2015. Operating System: Fundamental Concepts and Programming. New Delhi: S. Chand Publishing.ISBN 978-9385676352

4.Bhosale, Ramesh R.*Operating System.* Pune: Nirali Prakashan, 2022. ISBN 9789356452282.

5.Shinde, S. V.*Operating Systems (OS).* Pune: TechKnowledge Publications, 2022. ISBN 9789391039297.

6.Silberschatz, Abraham, Peter Baer Galvin, and Greg Gagne. 2018. Operating System Concepts. 9th ed. Adapted by Rachit Raj and Varsha Apte. New Delhi: Wiley India Pvt. Ltd. ISBN 978-1118063330

B.Sc. Part II, Semester III

BCSEPSEC 1-: Operating System

(Total Credit 2)

Course Objectives: Student will be able to…

1) study of different types of Operating System and their services.
2) learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3) understand Memory management Concepts
4) discuss Deadlock and Concurrency concepts

	Practicals	
	1. To explore and demonstrate basic system monitoring tools in Linux using both GUI and terminal commands like top, htop, uptime, and free. 2. To use Linux commands for file and directory operations such as ls, cp, mv, rm, mkdir, rmdir, and touch. 3. To navigate the Linux file system using commands like cd, pwd, and to manage file permissions using chmod, chown, and umask. 4. To create and edit files using the vi editor, and perform basic text editing operations including insert, delete, search, and save. 5. To write a shell script that performs basic arithmetic operations (addition, subtraction, multiplication, division) using command-line input. 6. To write shell scripts using loops (for, while, until) and demonstrate control statements like break and continue. 7. To use Linux filters and pattern searching tools like grep, awk, sed, sort, cut, and uniq for data extraction and processing. 8. To write shell scripts that use conditional statements (if, if-else, elif) to perform decision-making tasks. 9. To develop a shell script case study that automates a system task, such as a backup script or a user creation tool, with logging and validations. 10. To create a mini-project using shell scripting that integrates file management, input/output, loops, conditionals, and system commands	

Course Outcomes: Student will be able to…

1. apply the different services provided by Operating System at different level.
2. execute real life applications of Operating System in every field.
3. use of different process scheduling algorithm and synchronization techniques to avoid deadlock.
4. build different memory management techniques like paging, segmentation and demand paging etc.

Reference books:

1.Godbole, A. S., and Kailash Pathak. 2014. Operating Systems. 3rd ed. New Delhi: Tata McGraw-Hill Publishing Company.ISBN 978-0070702035

2.Dhamdhere, D. M.*Operating Systems: A Concept-Based Approach.* 3rd ed. New Delhi: McGraw-Hill Education, 2017. ISBN 9781259005589.
3.Rajiv, Chopra. 2015. Operating System: Fundamental Concepts and Programming. New Delhi: S. Chand Publishing.ISBN 978-9385676352
4.Bhosale, Ramesh R.*Operating System.* Pune: Nirali Prakashan, 2022. ISBN 9789356452282.
5.Shinde, S. V.*Operating Systems (OS).* Pune: TechKnowledge Publications, 2022. ISBN 9789391039297.
6.Silberschatz, Abraham, Peter Baer Galvin, and Greg Gagne. 2018. Operating System Concepts. 9th ed. Adapted by Rachit Raj and Varsha Apte. New Delhi: Wiley India Pvt. Ltd. ISBN 978-1118063330

B.Sc. Part II, Semester III

BCSETOE 3: Business Economics
(Total credit 2)

Course Objectives: Students will be able to ……..

1) compute various Price and Quantity Index number.
2) study time series methods for data presentation.
3) understand the concepts of Time series and Index numbers.
4) discuss data and interpret the results.

Unit	Content	No. of hours per
I	**Index Numbers** Meaning and utility of index numbers,Problems in the construction of index numbers,Types of index numbers: price, quantity, and value, Unweighted and Weighted index numbers using Aggregate method, Average of price or quantity relative method, Index numbers using: Laspeyre's, Paasche's, and Fisher's methods,Tests of index numbers: test, Time reversal test, and Factor reversal tests, Illustrative examples.	**7**
II	**Time Series** Definition and Uses of Time Series,Components of time series,Methods of determination of trend,Progressive Average Method,Method of Moving Averages,Method of Least Squares (only for straight line),Determination of Seasonal Variations by Simple Average Method,Illustrative examples.	**8**

Course Outcomes: Student will be able to…

1) use relative change in price and quantity.
2) display data graphically and interpret graphs.
3) recognize, describe, and calculate the Time series.
4) apply various methods of Time series for data presentation**.**

Reference Books:-

1. Newbold P., William L. C., Thorne B., Statistics for Business and Economics, Pearson 2021.ISBN 978-0137335428
2. S.C.Gupta and V.K.Kapoor, Fundamental of Mathematical Statistics, 12th Edition, New Delhi, Sultan Chand and Sons Publication, 2020. ISBN 978-8180545283
3. S. C. Gupta. Fundamental of Statistics, 7th Edition, Mumbai, Himalaya Publishing House, 2018.ISBN 978-9350517697
4. A.M. Mood, F.A. Graybill and D.C.Boes, Introduction to the Theory of Statistics, Third Edition, New Delhi, Tata McGraw-Hill Pub. Co. Ltd., 2017.ISBN 978-0070854659
5. A. M. Goon, M. K. Gupta, B. Das Gupta, Fundamentals of Statistics, 9th Edition, Calcutta, The World Press Private Ltd., 2017. ISBN 978-8187567805
6. B. L. Agarwal, Basic Statistics, 6th Edition, New Delhi, New Age International Private Ltd. 2013.

ISBN 978-8122433807

B.Sc. Part II, Semester IV

BCSET-241: Object Oriented Programming Using C++

(Total Credits 2)

Course Objectives: Student will be able to…

1. study the concept Object Oriented Programming
2. understand the operators and control structure in C++
3. discuss the constructors and destructors
4. learn the concept of Inheritance, Polymorphism and it's types

Unit	Content	No. of hours
I	**Object Oriented Terminology** Introduction, need and requirement of object oriented programming ,Beginning with C++:What is C++ ?, Keywords, variables, constants, basic data types, memory management operators, Application of OOP , Basics concept of object oriented programming, Structure of C++ program ,Class and Object: introduction, specifying a class, access specifies, defining member function, creating objects, memory allocation for object, Array of object, Static data member, static member function, friend function	8
II	**Constructors and Destructor in C++** Concepts of Constructors, Types of constructors: Default, parameterized, copy, Overloaded constructors: multiple constructors in a class, constructors with default arguments, Destructor	8
III	**Inheritance** Introduction of Inheritance, Types of Inheritance : Single Inheritance, Multilevel Inheritance, Multiple Inheritance ,Hierarchical Inheritance, Hybrid Inheritance, Virtual base class, Abstract Class, Constructor in derived class	7
IV	**Polymorphism** Introduction of Polymorphism, Types of polymorphism: Compile time polymorphism ,Run time polymorphism, Compile time polymorphism: function overloading, operator overloading overloading unary and binary operators, rules for operator overloading Run time polymorphism :virtual function, rules for virtual function, pure virtual function	7

Course outcomes:

Student will be able to…

1. apply basic concepts of object oriented programming.
2. use various control structures to improve programming logic.
3. design classes and objects.
4. develop constructor and destructor.

References:

1. Bjarne Stroustrup, The C++ Programming Language (Boston: Addison-Wesley, 2013), 112. ISBN 978-0321563842

2. Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo, C++ Primer (Boston: Addison-Wesley, 2012), 89. ISBN 978-0321714114

3. Scott Meyers, Effective Modern C++ (Sebastopol: O'Reilly Media, 2014), 45.ISBN 978-1491903995
4. Herb Sutter, Exceptional C++ (Boston: Addison-Wesley, 2000), 77. ISBN 978-0201615623
5. Andrei Alexandrescu, Modern C++ Design (Boston: Addison-Wesley, 2001), 130. ISBN 978-0201704310
6. Stephen Prata, C++ Primer Plus (Indianapolis: Sams Publishing, 2011), 62. ISBN 978-0321776402

B.Sc. Part II, Semester IV

BCSET 242: Cyber Security Concepts

(Total Credits 2)

Course Objectives: Student will be able to…

1. understand various types of cyber-attacks and cyber-crimes .
2. learn threats and risks within context of the cyber security.
3. overview of the cyber laws & concepts of cyber forensics.
4. study the defensive techniques against these attacks.

Unit	Content	No. of hours
I	**Basic concepts of Cyber Security** Introduction, layers of security, Vulnerability, Cyber threat, Harmful acts, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats- Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.	8
II	**Cyberspace and the Law & Cyber Forensics** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction to computer forensics, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics	8
III	**Cybercrime: Mobile and Wireless Devices** Introduction to Mobile & Wireless Devices, Common Cyber, Threats to Mobile Devices, Wireless Network Vulnerabilities, Real-World Cases and Statistics	7
IV	**Cyber Security: Organizational Implications** Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.	7

Course Outcomes:

Student will be able to…

1. Analyze cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet common from such attacks.
2. Interpret and forensically investigate security incidents.
3. Apply policies and procedures to manage Privacy issues.
4. Design and develop secure software modules.

References:

1. Mishra, Vaishali A., Nitin N. Sakhare, Abhijit J. Patankar, and Navnath D. Kale.Cyber Security (Third Year IT, Semester 6). Pune: Nirali Prakashan, 2022. ISBN 978 93545153922.
2. Taunk, Bhupesh J., and Annasaheb B. Nimbalkar.Cyber Security. Pune: Nirali Prakashan, 2022. ISBN 978 9354513220
3. Borade, Monali R.Information and Cyber Security. Pune: Nirali Prakashan, 2021. ISBN 978 9351647096
4. Kumar, Saurabh. 2015. Cyber Laws and Information Technology. New Delhi: Bharat Law House. ISBN 978-9386920911
5. Jain, Nilakshi, and Ramesh Menon.Cyber Security and Cyber Laws. New Delhi: Wiley, 2020. ISBN 978 9390395750
6. Singh, Parminder. 2020. Information Security and Cyber Laws. New Delhi: Katson Books. ISBN 978-9380117317

B.Sc. Part II, Semester IV

BCSEP 243: Lab Course Based on BCSET 241 & BCSET 242

(Total Credit 2)

Course Objectives: Student will be able to

1. study the concept Object Oriented Programming.
2. understand the operators and control structure in C++.
3. learn the constructors and destructors, Inheritance, Polymorphism and its types.
4. discuss how to protect computers and networks

	Practical's	
	Group A-BCSET 241 1.To write programs using conditional and looping statements in C++ 2.To use of classes and object 3.To use static data members and static member functions in a class 4.To implement constructors and destructors in a C++ 5.To demonstrate single and multilevel inheritance in C++ 6.To perform multiple and hybrid inheritance using C++ 7.To demonstrate function overloading and function overriding in C++ 8.To overload operators in C++ 9.To use friend class and friend function in C++ 10 To implement virtual functions and runtime polymorphism **Group A-BCSET 241** 1. To understand basic cyber security concepts and their importance 2. To study different layers of security and perform threat modeling 3. To identify system vulnerabilities and understand various cyber threats 4. To analyze a case study on internet governance and cyber crime incidents 5. To explore digital forensics and methods of collecting digital evidence 6. To perform email forensics for identifying spoofed or malicious emails 7. To discuss cyber threats targeting mobile and wireless devices 8. To create a basic cyber security policy for an organization or institution 9. To discuss privacy challenges and rights in the digital era 10.To evaluate social media risks and promote security awareness practices.	

Course Outcomes:

Student will be able to…

1. use various control structures to improve programming logic, Design classes and objects.
2. apply constructor and destructor, operator overloading, inheritance, and polymorphism
3. design basic cyber security tools
4. apply common types of cyber attacks

References:

C++

1. Bjarne Stroustrup, The C++ Programming Language (Boston: Addison-Wesley, 2013), 112. ISBN 978-0321563842
2. Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo, C++ Primer (Boston: Addison-Wesley, 2012), 89. ISBN 978-0321714114
3. Scott Meyers, Effective Modern C++ (Sebastopol: O'Reilly Media, 2014), 45.ISBN 978-1491903995
4. Herb Sutter, Exceptional C++ (Boston: Addison-Wesley, 2000), 77. ISBN 978-0201615623
5. Andrei Alexandrescu, Modern C++ Design (Boston: Addison-Wesley, 2001), 130. ISBN 978-0201704310
6. Stephen Prata, C++ Primer Plus (Indianapolis: Sams Publishing, 2011), 62. ISBN 978-0321776402

Cyber Security

1.Mishra, Vaishali A., Nitin N. Sakhare, Abhijit J. Patankar, and Navnath D. Kale.Cyber Security (Third Year IT, Semester 6). Pune: Nirali Prakashan, 2022. ISBN 978 93545153922.
2.Taunk, Bhupesh J., and Annasaheb B. Nimbalkar.Cyber Security. Pune: Nirali Prakashan, 2022. ISBN 978 9354513220
3.Borade, Monali R.Information and Cyber Security. Pune: Nirali Prakashan, 2021. ISBN 978 9351647096
4.Kumar, Saurabh. 2015. Cyber Laws and Information Technology. New Delhi: Bharat Law House. ISBN 978-9386920911
5.Jain, Nilakshi, and Ramesh Menon.Cyber Security and Cyber Laws. New Delhi: Wiley, 2020. ISBN 978 9390395750
6.Singh, Parminder. 2020. Information Security and Cyber Laws. New Delhi: Katson Books. ISBN 978-9380117317

B.Sc. Part II, Semester IV

BCSET244: Web Multimedia II

(Total Credit 2)

Course Objectives: Student will be able to ….

1. understanding Multimedia Fundamentals.
2. study multimedia integration.
3. learn Multimedia Creation and Optimization.
4. discuss Attractive web using Multimedia.

Units	Content	No. of hours
I	**Introduction to Multimedia on the Web** Definition and significance of multimedia in web development, Components of multimedia: text, images, audio, video, animations. Image formats: JPEG, PNG, GIF, SVG. Image optimization techniques.	7
II	**Audio and Video Basics** Introduction to audio and video formats commonly used on the web, Embedding audio and video elements in HTML, Basic techniques for audio and video optimization, Using CSS to style multimedia elements, Applying styles to images, audio, and video components, Introduction to basic CSS animations.	8
III	**Advanced Multimedia Techniques** CSS image effects: filters, transitions, Image galleries and sliders using HTML, CSS, and JavaScript, Responsive image techniques, Custom audio and video controls using JavaScript, Introduction to HTML5 audio and video APIs, CSS animations and transitions.	7
IV	**Animation Techniques** Introduction to JavaScript animation libraries like Green Sock Animation Platform (GSAP), SVG animations using CSS and JavaScript, Creating interactive multimedia elements using HTML , CSS, and JavaScript, Implementing interactive features like image zoom, draggable elements, Using multimedia APIs (e.g., YouTube Data API, Sound Cloud API),Case studies of multimedia integration in web applications.	8

Course Outcomes: Student will be able to…

1. Understanding of Multimedia Fundamentals
2. Proficiency in Multimedia Tools and Technologies.
3. Multimedia Content Creation
4. Understand Multimedia Integration and Interactivity.

References:

1. Shotton, Mark A. (2014). "Computer Vision for Multimedia Applications:Methods and Solutions." Academic Press.ISBN 978-1609600242
2. Watson, Andrew, and Philip Rayner. (2012). "Multimedia Programming Using Max/MSP and Touch Designer." Focal Press.ISBN 978-1849699716
3. Steinmetz, Ralf, and Klara Nahrstedt. (2004). "Multimedia Systems." Springer.ISBN 978-3540408673
4. Horton, Sarah, and Steve Emily. (2018). "Web Development and Design Foundations with HTML ISBN 978-0136662402

B.Sc. Part II, Semester IV

BCSET 245 Computer Networks

(Total Credit 2)

Objectives: **Student will be able to…**

1. study the fundamental types of computer networks.
2. learn TCP/IP model merits & demerits.
3. discuss OSI model merits & demerits.
3. understand the role of various protocols in Networking

Unit	Content	No. of hoursper
I	**Basic Concepts of Computer Networks** Definition, Uses of Networks, Types of Networks, Reference Models: TCP/IP Model, The OSI Model, Comparison of the OSI and TCP/IP reference model. Architecture of Internet. Physical Layer: Guided transmission media, Wireless transmission media, Switching	7
II	**Protocols and Switching Devices** Data Link Layer - Design issues, Error Detection & Correction, Elementary Data Link Layer Protocols, Sliding window protocols Multiple Access Protocols - ALOHA, CSMA,CSMA/CD, CSMA/CA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, Data link layer switching: Use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.	8
III	**Network Layer Design Concepts** Network Layer: Network Layer Design issues, store and forward packet switching connection ,less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Link State Routing, Path Vector ,Routing, Hierarchical Routing; Congestion control algorithms, IP addresses, CIDR, Subnetting, SuperNetting, IPv4, Packet Fragmentation, IPv6 Protocol, Transition from IPv4 to IPv6, ARP, RARP.	7
IV	**Transport Layer Protocols Overview** Transport Layer: Services provided to the upper layers elements of transport protocol , addressing connection establishment, Connection release, Error Control & Flow Control, Crash Recovery. The Internet Transport Protocols: UDP, Introduction to TCP, The TCP Service Model, The TCP , Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Sliding Window, The TCP Congestion Control Algorithm.	8

Course Outcomes: Student will be able to…

1. use and explore the basics of Computer Networks and Various Protocols.
2. apply the World Wide Web concepts.
3. create a network and flow of information further

4. design easily the concepts of network security, Mobile Security,etc.

REFERENCES BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking (New Delhi: McGraw-Hill Education, 2017), 92.ISBN 978-1259064753
2. (Note: Though Forouzan is of Iranian origin, this edition is widely published and adopted in India, often included in Indian academic syllabi.) ISBN 978-8120349070
3. Brijendra Singh, Data Communications and Computer Networks (New Delhi: PHI Learning Pvt. Ltd., 2022), 107. ISBN 978-8120348455
4. Ajit Pal, Computer Networking: Principles, Protocols and Practice (New Delhi: PHI Learning, 2015), 134.ISBN 978-8120348646
5. Prakash C. Gupta, Data Communications and Computer Networks (New Delhi: PHI Learning Pvt. Ltd., 2013), 76. ISBN 978-8125915973
6. Rajneesh Agrawal and Bharat Bhushan Tiwari, Data Communication and Computer Networks (New Delhi: Vikas Publishing House, 2020), 119.ISBN 978-8125915973

BCSEP-246 Lab Course based on BCSET 244 &BCSET 245
(Total Credit 2)

Course Objectives: Student will be able to…

1. understanding Multimedia Fundamentals.
2. study multimedia integration.
3. discuss routing, addressing, and switching techniques effectively.
4. learn core data communication methods.

	Practicals	
	Group -A BCSET 244 1To create a webpage with text, images, and a background video 2.To design an image gallery with a slideshow feature 3.To embed and customize audio files on a webpage 4.To embed and enhance video playback on a webpage 5.To apply animation effects to text and images using CSS or JavaScript 6.To build an audio playlist with equalizer or visual effects 7.To perform basic video editing and optimization for the web 8.To apply CSS filters and hover effects to enhance images 9.To design responsive multimedia elements for different screen sizes 10To add overlay captions and improve navigation using multimedia features **Group -A BCSET 245** 1.To Study the OSI and TCP/IP Models 2.To Demonstrate Different Types of Networks (LAN, MAN, WAN) 3.To Study Wired and Wireless Transmission Media 4.To Demonstrate Error Detection Techniques (Parity Bit and CRC) 5.To Simulate the Working of ALOHA and CSMA/CD Protocols 6.To Identify and Understand Basic Network Devices 7.To Study Sliding Window Protocol with Animation or Coding 8.To Study and Perform IPv4 Addressing and Subnetting 9.To Understand the Working of TCP and UDP Protocols Using Socket Programming 10.To Demonstrate TCP Connection Establishment and Release (3-Way Handshake)	

Course Outcomes: Student will be able to…

1. understanding of Multimedia Fundamentals
2. proficiency in Multimedia Tools and Technologies.
3. multimedia Content Creation
4. design Multimedia Integration and Interactivity.

References:

1. Shotton, Mark A. (2014). "Computer Vision for Multimedia Applications:Methods and Solutions." Academic Press.ISBN 978-1609600242
2. Watson, Andrew, and Philip Rayner. (2012). "Multimedia Programming Using Max/MSP and Touch Designer." Focal Press.ISBN 978-1849699716
3. Steinmetz, Ralf, and Klara Nahrstedt. (2004). "Multimedia Systems." Springer.ISBN 978-3540408673
4. Horton, Sarah, and Steve Emily. (2018). "Web Development and Design Foundations with HTML ISBN 978-0136662402
5. Behrouz A. Forouzan, Data Communications and Networking (New Delhi: McGraw-Hill Education, 2017), 92.ISBN 978-1259064753
6. (Note: Though Forouzan is of Iranian origin, this edition is widely published and adopted in India, often included in Indian academic syllabi.) ISBN 978-8120349070
7. Brijendra Singh, Data Communications and Computer Networks (New Delhi: PHI Learning Pvt. Ltd., 2022), 107. ISBN 978-8120348455
8. Ajit Pal, Computer Networking: Principles, Protocols and Practice (New Delhi: PHI Learning, 2015), 134.ISBN 978-8120348646
9. Prakash C. Gupta, Data Communications and Computer Networks (New Delhi: PHI Learning Pvt. Ltd., 2013), 76. ISBN 978-8125915973
10. Rajneesh Agrawal and Bharat Bhushan Tiwari, Data Communication and Computer Networks (New Delhi: Vikas Publishing House, 2020), 119.ISBN 978-8125915973

B.Sc. Part II, Semester IV

BCSETVSCII: Data Analytics-I

(Total Credit 2)

Course Objectives: Students should be able to…

1. study algebraic manipulation and simplification techniques to solve mathematical problems.
2. learn mathematical operations efficiently using MATLAB.
3. discuss proficiency in data import and export using R.
4. deliver basic data visualization techniques in R.

	Practicals	
	Group A 1.Program to create vectors and matrices by using matlab. 2.Program to create Array Indexing and modification by using matlab. 3.Mathematical Expressions with symbolic variables by using matlab. 4.Program to Define and solve symbolic equation by using matlab. 5.Algebraic manipulation and simplificaton by using matlab. 6.Symbolic function in matlab. 7.Visualize symbolic function and equation by using matlab. 8.Numeric data type in matlab. 9.Calculus with symbolic maths by using matlab. 10.To solve a system of linear equations using MATLAB by applying matrix operations. Group B 11. Program to read csv file using R. 12. Program to import data from excel. 13. Program to create function. 14. Program to implement If condition using R. 15. Program to implement if-else condition using R. 16. Program to implement multiple if-else. 17. Program to implement for loop. 18. Program to implement while loop. 19. Statistical analysis for univariate data using R. 20. Statistical analysis for bivariate data using R.	

Course Outcomes: Students will be able to…

1. Recognize the principles behind curve fitting and how it is used to model data in MATLAB.
2. Create solutions for system of linear equations by using MATLAB.
3. Create data visualizations for exploratory analysis and presentation.
4. Apply statistical methods using R for data analysis.

Reference Books:

1. "R for Data Science" by Hadley Wickham and Garrett Grolemund: This book provides a comprehensive introduction to data science using R, 2016 ISBN 978-1491910368
2. "Advanced R" by Hadley Wickham: A guide to advanced programming techniques in R ,2017. ISBN 978-1138469327
3. "ggplot2: Elegant Graphics for Data Analysis" by Hadley Wickham: Learn how to create beautiful and informative visualizations using ggplot2 ,2017.ISBN 978-3319242750
4. "Text Mining with R: A Tidy Approach" by Julia Silge and David Robinson: Explore text mining and NLP techniques using R ,2018. ISBN 978-1491981658
5. Kumar, S. Swapna, and S. V. B. Lenina.MATLAB: Easy Way of Learning.New Delhi: PHI Learning, 2016.ISBN 978-8120351653
6.P. Patankar and S. Kulkarni, MATLAB and Simulink In-Depth: Model-based Design with Simulink and State flow, User Interface, Scripting, Simulation, Visualization and Debugging, 1st Edition, BPB Publications, 2022.ISBN 978-0190602062
7. Rudra Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers (New Delhi: Oxford University Press, 2020), 112.ISBN 978-8126555949
8. Shailendra Jain, Modeling and Simulation Using MATLAB - Simulink (New Delhi: PHI Learning, 2016), 88.ISBN 978-0198072447
9. Agam Kumar Tyagi, MATLAB and Simulink for Engineers (New Delhi: University Science Press, 2011), 143.ISBN 978-1119385134
10. K. Subramanian, MATLAB: An Introduction with Applications (Chennai: Oxford University Press, 2015), 99.ISBN 978-9332542099
11. Patankar, Priyanka, and Swapnil Kulkarni.MATLAB and Simulink New Delhi: BPB Publications, 2022. ISBN 978-9355511997

B.Sc. Part II, Semester IV
BCSETSEC-2: Linux Operating System
(Total Credit 2)

Course Objectives: Student will be able to…

1. study the concepts of Operating System
2. understand Linux commands.
3. learn VI editor Concepts
4. discussShell Programming

Units	Content	No. of hours
I	**Basic Concepts of Operating System** Basics of Unix. Introduction to Linux, Comparison of Linux with Windows operating system. , Architecture of Linux , Login, Logout, Shell, Kernel, GPU Commands (cal, date, whoetc) ,	7
II	**Linux Commands** Directory management(mkdir, cd, rmdir) ,File handling using Linux commands,commands –ls, cat,cp,mv,rm , Types of files, chmod command, Basic filter- head,tail,sort,grep	7
III	**VI Editor** Editor, Use of VI , Features of VI , Vi basics , different modes and working with VI, Command mode -cursor movements(k,j,h,l), delete(character, line, word), Screen up , down use of repeat factor , joining lines (J) , Input mode-switching with (I, o, r, s, a, I, O, R, S, A),ex mode – saving (w, x, q) , writing selecting lines to another file. , searching for pattern (/ and ?), Search and replace	9
IV	**Shell Programming** Concept of Shell scripting, Conditional statements-if, if else, case, looping-for, while, until, Continue and break statement. read, echo statement, Writing and executing shell script	7

Course Outcomes: Student will be able to…

1. Get knowledge of Operating System.
2. Use Linux Commands
3. Use VI Editor
4. Implement Shell Programming.

Reference Books:

1.Nagaraju, M. L., and Rashmi A.*Operating System.* Karnataka: iPublishCentral, 2019.
ISBN 978-9355962447.

2.Rai, Vishal.*Expert Linux Administration Guide.* New Delhi: BPB Publications, 2022.
ISBN 978-9355510983.

3Rai, Vishal. *Expert Linux Administration Guide.* New Delhi: BPB Publications, 2022.
ISBN 978-9355510983.

4.Gonzalez, Alberto.*Linux Server Cookbook.* New Delhi: BPB Publications, 2022.
ISBN 978-9355513601.

5. Rai, Vishal.*Linux Administration: A Beginner's Guide.* New Delhi: BPB Publications, 2022.
ISBN 978-9355510983

6.Flynt, Clif, Sarath Lakshman, and Shantanu Tushar. *Linux Shell Scripting Cookbook.* 3rd ed.
Mumbai: Packt Publishing, 2017. ISBN 978-1785882388.

7.Blum, Richard, and Christine Bresnahan. *Linux Command Line and Shell Scripting Bible.* 4th ed.
Hoboken, NJ: Wiley, 2020. ISBN 978-1119700937.

B.Sc. Part II, Semester IV

BCSTSEC 2: Lab: Based on BCSETSEC 2

(Total Credit 2)

Course Objectives: Student will be able to…

1) study the concepts of Operating System
2) understand Linux commands.
3) learn VI editor Concepts
4) discuss Shell Programming

	Practical	
	1.System Monitoring and Linux GUI 2.File and Directory Management Commands 3.Navigation and Permissions in Linux 4.VI Editor and Text Manipulation 5..Basic Shell Scripting - Arithmetic Operations 6.Looping and Control Statements in Shell 7. Filters and Pattern Searching 8. Conditional Statements in Shell Scripting 9. Advanced Shell Script Case Study 10. Combined Shell Script Project	

Course Outcomes:Student will be able to…

1) Get knowledge of Operating System.
2) Use Linux Commands
3) Operate VI Editor
4) Implement Shell Programming.

Reference Books:

1. Nagaraju, M. L., and Rashmi A.*Operating System*. Karnataka: iPublishCentral, 2019.

ISBN 978-9355962447.

2.Rai, Vishal.*Expert Linux Administration Guide*. New Delhi: BPB Publications, 2022.

ISBN 978-9355510983.

3Rai, Vishal. *Expert Linux Administration Guide*. New Delhi: BPB Publications, 2022.

ISBN 978-9355510983.

4.Gonzalez, Alberto.*Linux Server Cookbook.* New Delhi: BPB Publications, 2022.
ISBN 978-9355513601.
5. Rai, Vishal.*Linux Administration: A Beginner's Guide.* New Delhi: BPB Publications, 2022.
ISBN 978-9355510983
6.Flynt, Clif, Sarath Lakshman, and Shantanu Tushar. *Linux Shell Scripting Cookbook.* 3rd ed.
Mumbai: Packt Publishing, 2017. ISBN 978-1785882388.
7.Blum, Richard, and Christine Bresnahan. *Linux Command Line and Shell Scripting Bible.* 4th ed.
Hoboken, NJ: Wiley, 2020. ISBN 978-1119700937.

B.Sc. Part II, Semester IV

BCSETVEC 2: Environmental Awareness for Computer Science (Entire)

(Total Credit 2)

Course Objectives: Student will be able to…

1. study the Environmental Issues
2. understand the Role of Computer in creation of environmental issues
4. learn the Sustainable development goals
5. discuss the Computational Sustainability

Units	Content	No. of hoursper
I	**Environmental issues** Pollution (Air, water and Land), Fresh-water overuse, Natural disasters, Fule and Energy shortage due to overuse, Increase in wasteland, Biodiversity loss, Global warming and climate change(Causes and intensity of the problem), role of Computer in creation of environmental issues.	8
II	**Environmental laws and ethics** Environmental Protection Act, Wildlife Protection Act, Forest Conservation Act, Prevention and Control of Pollution Act (Air, Water, Land), from unsustainable to sustainable development, Responsibilities of an Environmentally aware citizen.	7
III	**Sustainable Development Goals** Implementation, History, Structure of goals, targets and indicators, Goals with their targets and indicators, Challenges in sustainable development of goals in Environmental Awareness of Computer Science	8
IV	**Role of Computer Science (Entire) in meeting the sustainable development goals** Computational sustainability, Computational Research in	7

	Sustainability, Balancing environmental and socioeconomic needs, Biodiversity and conservation, Computational Synergies, Green IT	

Course outcomes:

Student should be able to…

1. use Environmental issues
2. apply Environmental Laws and Ethics are work
3. design sustainable development of goals in Environmental Awareness of Computer Science
4. create environmental and socioeconomic needs

References:

1. Kumar, Arvind. *Environmental Awareness.* Jaipur: Book Saga Publications, 2023. ISBN 978-9395470629.

2.Patil, Ameya. *Environmental Awareness for B.Com., BBA, and BBA (CA): AICTE Semester 1.* Pune: Nirali Prakashan, 2024. ISBN 978-9361093678.

3.Sahgal, Abha. *Awareness Environmental Studies Introductory.* New Delhi: S. Chand Publishing, 2016. ISBN 978-9352830916.

4.Basak, Anindita. *Environmental Studies.* Delhi: Pearson Education India, 2014. ISBN 978-8131721186.

5.Pagnis, Ravikant. *Environment and Sustainability For GTU Diploma Computer Engineering Sem 1.* Ahmedabad: TechKnowledge Publications, 2021. ASIN B09PBJDCDZ *(no ISBN)* — recommend checking publisher.

6.Bhambri, Pankaj, and Paula Bajdor (eds.). *Handbook of Technological Sustainability: Innovation and Environmental Awareness.* Boca Raton: CRC Press/ Taylor & Francis, 2024. ISBN 978-1003475989