RANI CHANNAMMA UNIVERSITY BELAGAVI

THE COURSE STRUCTURE AND SYLLABUS OF UNDERGRADUATE

B.C.A PROGRAMME

w.e.f.

Academic Year 2024-25 and Onwards Under

State Education Policy (SEP)

Submitted by
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Part	Course Code	Subject Name	Teaching Hrs / week	Practical Hrs / week	Exam Duration Hrs	IA	Theory/Practical	Total	Credits
III Semester BCA w.e.f 2025-26 and onwards									
					Examination				
							Marks		
Part I AECC	SEPBCAAECT 3.1	Language 1	4	-	3	20	80	100	3
	SEPBCAAECT 3.2	Language 2	4	-	3	20	80	100	3
Part II DSC	SEPBCADSCT3.3	Python Programming	4	-	3	20	80	100	3
	SEPBCADSCT 3.4	Advanced Java programming	4	-	3	20	80	100	3
	SEPBCADSCT 3.5	Operating System	4	-	3	20	80	100	3
	SEPBCADSCP 3.6	Python Programming - Lab	-	4	3	10	40	50	2
	SEPBCADSCP 3.7	Advanced Java Programming - Lab	-	4	3	10	40	50	2
	SEPBCADSCP 3.8	Operating System - Lab	-	4	3	10	40	50	2
Part III SEC	SEPBCASECT 3.9#	Compulsory (C)	2	-	2	10	40	50	2
Part IV Elective	SEPBCASECT 3.10* (Elective-I)	Open Source Tools(OST)	2	-	2	10	40	50	2
		Internet Of Things(IOT)							
Total			22	12				700	25

AECC : Ability Enhancement Compulsory Courses, DSC : Discipline Specific Courses, SEC : Skill Enhancement Courses, C- Compulsory Course

Note :

1. For the SEPBCASECT 3.9 the semester-end examination will consist of multiple-choice questions.
2. For the SEPBCASECT 3.10 Elective subject, the semester-end examination will consist of multiple-choice questions. Two electives are offered, and students are required to choose only one. The college must ensure that a minimum of 20 students are enrolled in each elective.

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Part	Course Code	Subject Name	Teaching Hrs / week	Practical Hrs / week	Exam Duration Hrs	Marks IA	Marks Theory/ Practical	Marks Total	Credits
IV Semester BCA w.e.f 2025-26 and onwards									
Part I AECC	SEPBCAAECT 4.1	Language 1	4	-	3	20	80	100	3
	SEPBCAAECT 4.2	Language 2	4	-	3	20	80	100	3
Part II DSC	SEPBCADSCT4.3	Design & Analysis of Algorithms	4	-	3	20	80	100	3
	SEPBCADSCT 4.4	Web Programming	4	-	3	20	80	100	3
	SEPBCADSCT 4.5	Computer Networks	4	-	3	20	80	100	3
	SEPBCADSCP 4.6	Design & Analysis of Algorithms - Lab	-	4	3	10	40	50	2
	SEPBCADSCP 4.7	Web Programming – Lab	-	4	3	10	40	50	2
	SEPBCADSCP 4.8	Computer Networks – Lab	-	4	3	10	40	50	2
Part III SEC (Skill)	SEPBCASECT 4.9	Practical Knowledge/Skill : User Interface And User Experience (UI/UX)	2	-	2	10	40	50	2
Part IV Elective	SEPBCASECT 4.10* (Elective-II)	Personality Development	2	-	2	10	40	50	2
		Employability Skills							
Total			24	12				750	25

AECC : Ability Enhancement Compulsory Courses, DSC : Discipline Specific Courses, SEC : Skill Enhancement Courses

Note : *

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2. For the SEPBCASECT 4.10 Elective subject, the semester-end examination will consist of multiple-choice questions. Two electives are offered, and students are required to choose only one. The college must ensure that a minimum of 20 students are enrolled in each elective.

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Year	II	Course Code: SEPBCADSCT 3.3		Credits	03
Semester	III	Course Title: Python Programming (Theory)		Hours	48
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.		

Course Outcomes	After completing this course satisfactorily, a student will be able to: • Setup Python to develop simple applications • Understand the basic concepts in Python Programming, Learn how to write, debug and execute Python programs. • Understand and demonstrate the use of advanced data types such as tuples, dictionaries and lists, Tuples and Sets. • Design solutions for problems using object-oriented concepts in Python • Use and apply the different Python Libraries for GUI Interface, Data Analysis and Data Visualization. • Extend the knowledge of python programming to build successful career in software development.

Unit No.	Course Content	Hours
UNIT I	**Introduction to Python:** Working with python, Variables, expressions, and statements, accepting user input. Conditional execution. Nested conditionals, Iteration, Function Basics Built-in Functions. Recursion, Scope Global, Local variables. Modules: Creating and importing modules importing all or specific classes from module.	10
UNIT II	**Functions :** Declaring and calling User defined functions, Parameters and default arguments. Lambda-- functions as objects, map() function, Strings, indexing. Slicing. Lists, Dictionaries and Tuples. Files: Opening the file-modes: read, write, append. Reading from and writing to a file, closing, deleting a file.	10
UNIT III	**Exceptions :** Exceptions in Python, Handling Exceptions: try block, except block, else block, finally block. Raising an exception, User defined exception. **Object-Oriented Programming :** Classes defining classes with **init**() and methods. creating objects, class variables and instance variables, Inheritance super() function.	09
UNIT IV	**Regular Expressions :** Concept of regular expression, meta characters, using match() function, search(), findall(), sub() and split() functions. GUI **Programming in Python (using Tkinter):** Introduction to GUI library. Layout management with pack, grid and place. Widgets with their attributes: Frame, Label, Button, Checkbutton, Radiobutton. Entry. Listbox. Text. Events and bindings. Drawing on canvas (line, oval, rectangle. arc.).	11
UNIT V	**Database connectivity in Python :** Installing mysql connector. Accessing connector module. Using connect, cursor. execute & close functions, Executing different types of SQL statements. Executing transactions. Network Programming .	08

Recommended Leaning Resources

Text Books:

1. Introduction to Computing and Problem Solving Using Python, E Balaguruswamy, McGrawHill, First Edition
2. Advance Core Python Programming, Meenu Kohli, 2021, BPB Publications

Reference Books:

1. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, 2015, Green Tea Press. Freely available online @
   https://www.greenteapress.com/thinkpython/thinkCSpy.pdf
2. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python
3. Programming Language, Fabio Nelli, 2015, Apress®
4. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, 2012, Prentice Hall
5. Automate the Boring Stuff, Al Sweigart, 2015, No Starch Press, Inc.
6. Data Structures and Program Design Using Python, D Malhotra et al., 2021, Mercury Learning and Information LLC
7. http://www.ibiblio.org/g2swap/byteofpython/read/
8. https://docs.python.org/3/tutorial/index.html

Year	II	Course Code: SEPBCADSCT 3.4		Credits	03
Semester	III	Course Title: Advanced Java programming (Theory)		Hours	48

Course Pre-requisites, if any	NA		
Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.	

Course Outcomes	At the end of the course, the students should be able to: • Develop GUI-based desktop applications using Swing • Understand event handling in Java. • Create dynamic web pages using JSP. • Implement JDBC for database operations. • Build network-based applications using Sockets

Unit No.	Course Content	Hours
UNIT I	**Event Handling:** Event, Event Source, Event Classes, Event Listener interface, Examples, Handling Windows Events, Adapter Classes, Inner classes.	08
UNIT II	**Swing:** Introduction to JFC (Java Foundation Classes), Swing, Swing Features, JComponent, JApplet, JFrame, JPannel, JTextField, JButtons, JCheckBox and JRadioButton, JComboBox, JScrollPane, JList.	10
UNIT III	**JDBC Architecture:** Introduction to JDBC, Java and JDBC, JDBC VS ODBC, JDBC DRIVER MODEL, JDBC Driver Types, Types of Driver Managers, JDBC Connection process, Statement object, preparedStatement object, operations on Resultset (Read, insert, update and delete), transaction processing, Metadata, Resultset Metadata, Data types.	12
UNIT IV	**Introduction to JSP and Its Lifecycle, JSP Directives:** page, include, taglib, JSP Scripting Elements: Declarations, Scriptlets, Expressions, JSP Implicit Objects: request, response, session, application, out, config, JSP Standard Actions: jsp:include, jsp:forward, jsp:useBean, JSP with JDBC for Database Connectivity. Introduction to Java Beans	10
UNIT V	**Networking Basics, InetAddress,** TCP/IP Client-Server Socket, URL Connection, HTTPURL Connection, Datagram, Introduction To EJB, Types of EJB.	08

Recommended Leaning Resources

Text Books:

1. Jim Keogh, J2EE: The complete Reference, McGrawHill
2. Herbert Schildt, The Java 2 : Complete Reference, Fourth edition,TMH
3. https://docs.oracle.com/javase/tutorial/

Reference Books:

1. H. M. Deitel, P. J. Deitel, Java: how to program, 5th edition, Prentice Hall ofIndia.
2. Y. Daniel Liang, Introduction to Java programming, 9thEdition, Pearson education.
3. Cay S Horstmann,Fary Cornell, Core Java 2, Volume – I&II, Sun MicrosystemsPress

Year	II	Course Code: SEPBCADSCT 3.5		Credits	03
Semester	III	Course Title: Operating System (Theory)		Hours	48
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.		

Course Outcomes	At the end of the course, students will be able to: • Explain the fundamentals of the operating system. • Comprehend multithreaded programming, process management, process synchronization, memory management and storage management. • Compare the performance of Scheduling Algorithms • Identify the features of I/O and File handling methods.

Unit No.	Course Content	Hours
UNIT I	**Introduction to Operating Systems:** Basics of operating system - Definition, History and Examples of Operating System; Computer System organization; Types of Operating Systems; OS Services; System Calls, Types of system call; Operating System Structure.	08
UNIT II	**Process Management:** Process Concept - Process Definition, Process State, Process Control Block, Context Switching; Inter process communication (IPC) - Definition, IPC Models - Shared memory and Massage passing; Thread - Definition, Advantages, Types of threads, Multithreading Models. CPU Scheduling criteria, CPU Scheduling Algorithms (FCFS, SJF, Priority, RR).	10
UNIT III	**Process Synchronization:** Introduction, Race Conditions, Critical Section Problem and Peterson's Solution; Semaphores, The Producer Consumer Problem; Dining Philosophers Problem. **Deadlocks:** Definition, System Model; Deadlocks Characterization, Resource Allocation graph; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance, Bankers Algorithm with problem; Deadlock Detection; and Recovery from Deadlock.	10
UNIT IV	**Memory Management:** Logical and Physical Address Space; Swapping; Contiguous Memory Allocation, Fragmentation - Internal, External and compaction; Paging; Segmentation; Segmentation with Paging. **Virtual Memory:** Introduction to Virtual Memory; Demand Paging; Page Replacement; Page Replacement Algorithms (FIFO, LRU, and Optimal)	10
UNIT V	**I/O Management:** I/O Devices and I/O Functions, Disk Structure, Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK) **File Management:** File Concepts - Attributes, Operations and Types of Files; File Access methods; Directory Structure; Protection; File System Implementation- File System Structure, Allocation Methods, Free Space Management	10

Recommended Leaning Resources
Text Books:
1. Operating System Concepts, Silberschatz' et al., 10thEdition, Wiley, 2018. 2. Operating Systems – A Concept Based Approach, Dhamdhere, 3rd Edition, McGraw Hill Education India.
Reference Books:
1. Operating System Concepts - Engineering Handbook, Ghosh PK, 2019. 2. Understanding Operating Systems, McHoes A et al., 7th Edition, Cengage Learning, 2014. 3. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson. 4. Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson.

Year	II	Course Code: SEPBCADSCP 3.6	Credits	02
Semester	III	Course Title: Python Programming - Lab		

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:

1. Python program to solve the Fibonacci sequence using recursion.
2. Python function to check whether a number is perfect or not.
3. Python program to converting an Integer to a String in any base.
4. Python program that uses List Comprehension to perform any 3 of the following tasks.
   a. Create an output list which contains only the even numbers from the input list.
   b. Create an output list which contains squares of all the numbers from 1 to 9.
   c. Create an output list which extracts all the numbers from an input string.
5. Python program to count the number of lines in a text file.
6. Python program to copy the contents of a file to another file.
7. Python GUI program to draw various shapes on Canvas.

Part A

1. Python function to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.
2. Python function that takes a list and returns a new list with unique elements of the first list.
3. Python program of recursion list sum.
4. Python program to get the sum of digits of a non-negative integer.
5. Python program to demonstrate any 5 string and List operations.
6. Create an output tuple that converts the words to uppercase from the input tuple of words.
7. Python program to demonstrate any 5 operations performed on dictionary.
8. Python program to create a module Calculation.py that contains functions to perform basic arithmetic operations. Demonstrate importing the module.

Part B

1. Python program to demonstrate modification of an existing table data from MySQL database.
2. Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle.
3. Python class named Rectangle constructed by a length and width and a method which will compute the area and perimeter of rectangle. Inherit a class Box that contains additional method volume. Override the perimeter method to compute perimeter of a Box.
4. Python program to show use of Regular expressions with match(), search(), findall(), sub() and split().
5. python program to demonstrate Exception handling using 'try', 'except', 'finally' and 'else block.
6. Python program to read a file line by line store it into an array.
7. Python GUI program to design Student Registration Form using any 5 widgets.

Instructions:

➢ Certified Journal is mandatory for every student to appear for the examination.
➢ Student has to execute all programs in each part to complete the Lab course.
➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	II	Course Code: SEPBCADSCP 3.7	Credits	02
Semester	III	Course Title: Advanced Java Programming - Lab		

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:

1. Design GUI-based applications using Swing components
2. Demonstrate database connectivity (JDBC) for performing operations on relational databases.
3. Apply JSP and JavaBeans to build dynamic web applications
4. Implement client-server communication using TCP/IP sockets in Java networking applications.
5. Write a JSP program to display date and time.

Part A

1. Java program to implement mouse events like mouse pressed, mouse released and mouse moved by means of adapter classes.
2. Java program to implement keyboard events.
3. Java program to illustrate basic calculator using grid layout manager.
4. Design a ice-cream menu form that displays 4 flavors. Display the flavors selected by the user.
5. Java program to demonstrate the use of JRadioButton.
6. Java program to demonstrate the use of JCheckbox.
7. Java program that loads names and phone numbers from a database file. It takes a name as input and prints the phone number.
8. Java program that connects to a database using JDBC. Demonstrate insertion and modification of table data.

Part B

1. JSP program to create a sample order form containing the fields Item, Price, Quantity, Total Price.
2. JSP program to create a login system that maintains user session data.
3. JSP program to create Currency Converter application. (Allow users to select currencies for conversion using options)
4. JSP program for Email validation by accessing e-mail information from database.
5. JSP program to create Admission form. Store admission details in database.
6. JSP program to create Registration Form. Store and display details using Java Beans.
7. Java program to establish client server communication using TCP/IP socket.
8. Java Program to find the IP address of a given website specified by the user..

Instructions:

➢ Certified Journal is mandatory for every student to appear for the examination.
➢ Student has to execute all programs in each part to complete the Lab course.
➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	II	Course Code: SEPBCADSCP 3.8	Credits	02
Semester	III	Course Title: Operating System - Lab		

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:
1. C program to simulate OPR page replacement algorithm.
2. C program to simulate SCAN disk scheduling algorithm.
3. Shell Script to find the factorial of a given number.
4. Shell Script to display date, time, user details, contents of the current directory and the rights of the files in current directory.

Part A (Using C Programming)

1. C program to simulate producer-consumer using semaphores.
2. C program to simulate FCFS CPU Scheduling algorithm to find turnaround time & waiting time.
3. C program to simulate SJF CPU Scheduling algorithm to find turnaround time & waiting time.
4. C program to simulate Priority CPU Scheduling algorithm to find turnaround time & waiting time.
5. C program to simulate RR CPU Scheduling algorithm to find turnaround time & waiting time.
6. C program to simulate Bankers Algorithm for Deadlock Avoidance.
7. C program to simulate FIFO page replacement algorithm.
8. C program to simulate LRU page replacement algorithm.

Part B (Unix Shell Programming)

1. Shell script to generate mark-sheet of a student by reading five subject marks, calculate and display total marks, percentage and Class obtained by the student.
2. Shell script that display first n Fibonacci numbers as output.
3. Shell script to read n numbers as command arguments and sort them in descending order.
4. Shell script to read 2 filenames and find which file has a greater number of words (line/characters).
5. Shell script to find which file is older.
6. Shell script to check entered string is palindrome or not.
7. Shell script to perform basic arithmetic operations (use case statement).
8. Shell script to determine whether a given file exists or not, file name is supplied as command line argument block.

Instructions:
➢ Certified Journal is mandatory for every student to appear for the examination.
➢ Student has to execute all programs in each part to complete the Lab course.
➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	II	Course Code: SEPBCASECT 3.9		Credits	02
Semester	III	Course Title: Compulsory		Hours	30
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 10		Summative Assessment Marks: 40	Duration of ESA: 02 hrs.		
Course Outcomes					
Unit No.		Course Content			Hours

To be provided by university

Recommended Leaning Resources

Year	II	Course Code: SEPBCASECT 3.10 (Elective I)		Credits	02
Semester	III	Course Title: Open Source Tools (OST)		Hours	30
Course Pre-requisites, if any			NA		
Formative Assessment Marks: 10		Summative Assessment Marks: 40	Duration of ESA: 02 hrs.		

Course Outcomes	At the end of the course, students will be able to: • Recognize the benefits and features of Open Source Technology and to interpret, contrast and compare open source products among themselves • Use appropriate open source tools based on the nature of the problem • Write code and compile different open-source software.

Unit No.	Course Content	Hours
UNIT I	**Open Source Software's :** Introduction to Open sources, Need of Open Sources, Open Source, Principles, Standard Requirements, Advantages of Open Sources, Free Software – FOSS, Licenses – GPL, LGPL, Copyrights, Patents, Contracts & Licenses and Related Issues, Application of Open Sources. Open Source Operating Systems : FEDORA, UBUNTU	10
UNIT II	**Programming Tools and Techniques :** Usage of design Tools like Argo UML or equivalent, Version Control Systems like Git or equivalent, Bug Tracking Systems (Trac, BugZilla), BootStrap.	10
UNIT III	**Case Studies :** Apache, Berkeley Software Distribution, Mozilla (Firefox), Wikipedia, Joomla, GNU Compiler Collection, Libre Office.	10

Recommended Leaning Resources
Text Books: 1. KailashVadera, Bhavyesh Gandhi, "Open Source Technology", Laxmi Publications Pvt. Ltd 2012, 1st Edition.
Reference Books: 1. Fadi P. Deek and James A. M. McHugh, "Open Source: Technology and Policy", Cambridge Universities Press 2007.

Year	II	Course Code: SEPBCASECT 3.10(Elective I)		Credits	02
Semester	III	Course Title: Internet of Things (IOT)		Hours	30
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 10		Summative Assessment Marks: 40		Duration of ESA: 02 hrs.	

Course Outcomes	At the end of the course, students will be able to: • Understand the foundational concepts of IoT • Analyze the role of IoT in various domains. • Understand the IoT devices and their role in the IoT ecosystem • Understand IoT design methodologies for system development.

Unit No.	Course Content	Hours
UNIT I	**Introduction of Internet of Things:** Definition and characteristics of IOT, **Physical design of IOT**: Things in IOT, IOT Protocols, Logical **Design of IOT:** IOT Functional Blocks, IOT Communication Models, IOT Communication APIs, IOT Enabling Technologies, **IOT Templates:** IOT level-1, level-2, level-3, level-4, level-5 and level-6	10
UNIT II	**Domain Specific IOTs and M2M:** Introduction: Home Automation, Cities, Environment, Energy, Retail, Logisitics, Agriculture, Industry and Health & Lifestyle, Introduction to M2M, M2M, difference between IOT and M2M, Software Defined Networking (SDN), Network Function Virtualization (NFV) for IOT	10
UNIT III	**IOT Physical Device and Endpoints:** What is an IOT Device, Basic building blocks of an IOT, **Exemplary Device:** Raspberry Pi Interfaces, Programming Raspberry Pi with Python. **Case study Illustrating IOT Design:** Smart Lighting, Home intrusion Detection, Smart parking, Weather Reporting Bot, Air Pollution Monitoring, forest fire Detection	10
	Recommended Leaning Resources	

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015

2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit2).

3. Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer,2011.

5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O"Reilly Media,2011

Year	II	Course Code: SEPBCADSCT 4.3		Credits	03
Semester	IV	Course Title: Design & Analysis of Algorithms (Theory)		Hours	48
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.		

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand the fundamental concepts of algorithms and their complexity, including time and space complexity, • Design algorithms for solving various types of probleml using various algorithm design techniques • Analyze and compare the time and space complexity of algorithms with other algorithmic techniques. • Evaluate the performance of various algorithm design techniques • Apply various algorithm design to real-world problems and evaluate their effectiveness and efficiency in solving them.		

Unit No.	Course Content		Hours
UNIT I	**Introduction:** What is an Algorithm? Performance Analysis – Space Complexity, Time Complexity, Worst-case, Best-case and Average-case efficiencies. **Asymptotic Notations:** Introduction, O-notation, Ω-notation, θ-notation		09
UNIT II	**Divide-and-Conquer:** Introduction, Strassen's Matrix Multiplication, Finding Max Min, Topological Sorting, Analysis of Binary Search Algorithm **Decrease and Conquer:** Introduction, Sorting by Counting, String matching using Horspool Algorithm		09
UNIT III	**Greedy Technique:** Introduction, Knapsack Problem, Minimum Cost Spanning Tree - Prim's Algorithm, Kruskal's Algorithm, Single Source Shortest Path - Dijkstra's Algorithm, Job sequencing with deadlines		10
UNIT IV	**Dynamic Programming:** General Method, Multistage graphs, Warshall's Algorithm, Travelling Salesman Problem		10
UNIT V	**Basic Traversal and Search Techniques:** Binary Tree traversals and related properties, Depth First Search, Breadth First Search **Backtracking Techniques:** N-Queens problem, sum of subsets problem, Hamiltonian Cycles		10

Recommended Leaning Resources
Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009, Pearson
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014,Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest,
4. Clifford Stein, 3rd Edition, PHI.

Reference Books:

1. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)
2. Design and Analysis of Algorithms, Dr. S. Nandagopalan

3. Weblinks and Video Lectures (e-Resources):
   i. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
   ii. https://nptel.ac.in/courses/106/101/106101060/
   iii. http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html http://cse01-iiith.vlabs.ac.in/
   iv. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

Year	II	Course Code: SEPBCADSCT 4.4	Credits	03
Semester	IV	Course Title: Web Programming (Theory)	Hours	48

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand the basics of world wide web and web design principles. • To understand the need and be able to develop HTML/XHTML and CSS pages with valid structure as well as content. • Understand the importance XML in web development. • Understand and be able to develop JavaScript code to access the DOM structure of web document and object properties. • To develop dynamic web pages with usage of server-side scripting PHP.

Unit No.	Course Content	Hours
UNIT I	**The World Wide Web:** Introduction to world wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Applications, HTTP, HTTPS. Websites – Home Pages: Web Site Development ; stages of building Web Sites , Web Content Authoring, Web Graphics Design, Web Programming. Scripting languages, Applications of scripting, How scripting languages differ from non-scripting languages, Types of scripting languages.	08
UNIT II	**HTML:** Origins and evolution of HTML and XHTML, Basics of HTML, HTML Tags and attributes, Meta tags, Character entities, hyperlink, lists, tables, images, forms, divs, frames. **CSS-** Introduction, Levels of style sheets, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The <span> and <div> tags.	10
UNIT III	**XML:** Introduction, Meaning, significance and usage. **JavaScript:** Overview of JavaScript, Object Oriented and JavaScript, General Syntactic characteristics, Primitives, operations and expressions, Screen output and keyboard input, Control statements, Object creation and modification.	10
UNIT IV	**Arrays, Functions, Constructor** Element access in JavaScript, Event and event Handling , Handling events from body elements, Handling events from button elements, Handling events from Textbox and password elements.	10
UNIT V	**Server side scripting:** Server-side web scripting, PHP : PHP uses, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors / problems.	10

Recommended Leaning Resources

Text Books:

1. Thomas Powell, Web Design The complete Reference, Tata McGrawHill
2. Chris Bates, "Web Programming: Building Internet Applications", 3rd Edition Wiley 2009
3. Eric Freeman, "Head First HTML with CSS and XHTML", O"Rielly,2006.
4. David Flnagan, "JavaScript, The Definitive Guide", 6th Edition, O"Rielly2011.
5. PHP for the Web: Visual Quick Start Guide, 4th Edition, Peachpit Press
6. S SGornale&Basavanna M, ""Web Programming for Beginners", ISBN: 978-93-5213-363-5, Shroff Publisher & Distributors PVT Ltd, Mumbai-2016

Reference Books:

1. Internet & World Wide Web – How to Program – Deitel & Deitel – Fourth edition
2. Steven M. Schafer, HTML, CSS, JavaScript, Perl, Python and PHP - Web standards Programmer's Referencell, Wiley Publishing, Inc.
3. W3Schools: PHP (http://www.w3schools.com/php/)
4. PHP Language Reference (http://php.net/manual/en/langref.php)
5. W3Schools: JavaScript(https://www.w3schools.com/js/default.asp)

Year	II	Course Code: SEPBCADSCT 4.5	Credits	03
Semester	IV	Course Title: Computer Networks (Theory)	Hours	48

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Explain the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data. • Apply the basics of data communication and various types of computer networks in real world applications. • Compare the different layers of protocols. • Evaluate the key networking protocols and their hierarchical relationship in the conceptual model like TCP/IP and OSI. • Understand basic routing algorithms.

Unit No.	Course Content	Hours
UNIT I	**Introduction:** Computer Networks and its applications, Network structure, network architecture, Topologies, LAN, WAN, MAN, The OSI reference model, The TCP/IP reference model.	08
UNIT II	**The Physical Layer:** Transmission Media – Twisted pair, coaxial cable, optical fiber, radio transmission, microwaves and infrared transmission, Switching - message switching, circuit switching, packet switching. Multiplexing - FDM, TDM. **Modulation:** ASK, PSK , FSK.	10
UNIT III	**The Data Link Layer:** Data Link Layer design issues, Error detection – Single parity checking, Checksum, polynomial codes – CRC, Error correction-Hamming code, **Elementary data link protocols:** Unrestricted simplex protocol, simplex stops and waits protocol. Sliding window protocols - sliding window go back n, selective repeat protocols.	10
UNIT IV	**The Network Layer:** Network layer design issues, Routing algorithms – Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion, control algorithms – Leaky bucket, token bucket algorithm, Hop by Hop choke packets. Network layer in the Internet- IPV4, IP Addresses.	10
UNIT V	**The Transport Layer and Application Layer:** Elements of Transport service, TCP-service model, TCP protocol, TCP Segment Header, TCP Connection Establishment, Connection Release, TCP sliding Window, TCP timer Management, TCP Congestion control. Application Layer: DNS-**Namespace, Name servers;** E-Mail- Architecture and Services World Wide Web.	10

Recommended Leaning Resources
Text Books:
1. Data Communication & Networking, Behrouza A Forouzan, 3rd Edition, Tata McGraw   2. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education, 2010.   3. William Stallings, Data and Computer Communications, 7th Edition, PHI.
Reference Books:
1. W. Stalling, Wireless Communication and Networks, Pearson Education.   2. Brijendra Singh, Data Communication and Computer Networks, PHI.

Year	II	Course Code: SEPBCADSCP 4.6	Credits	02
Semester	IV	Course Title: Design & Analysis of Algorithms - Lab		

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:
- Program to perform heap sort.
- Program to perform Bubble sort.
- Program to perform Quick sort.
- Program to find Maximum and Minimum of the given set of integer values.

Part A (To be implemented using C programming / JAVA Programming)

1. Program to perform Knapsack Problem using Greedy Solution
2. Program to find minimum and maximum value in an array using divide and conquer.
3. Program that implements Strassen's Matrix Multiplication.
4. Program that implements Prim's algorithm to generate minimum cost spanning Tree.
5. Program that implements Kruskal's algorithm to generate minimum cost spanning tree.
6. Program to perform Travelling Salesman Problem
7. Program to implement Warshall's algorithm
8. Program to implement Sorting by Counting Algorithm

Part B (To be implemented using C programming / JAVA Programming)

1. Program that accepts the vertices and edges for a graph and stores it as an adjacency matrix.
2. program to implement function to print In-Degree, Out-Degree and to display that adjacency matrix.
3. Program to implement backtracking algorithm for solving problems like N queens
4. Program to implement the backtracking algorithm for the sum of subsets problem
5. Program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
6. Program to implement the DFS algorithm for a graph.
7. Program to implement the BFS algorithm for a graph.
8. Program to implement Dijkstra's Algorithm.

Instructions:
➤ Certified Journal is mandatory for every student to appear for the examination.
➤ Student has to execute all programs in each part to complete the Lab course.
➤ 10 marks of internal assessment (IA) will be awarded based on practical test.

| Year | II | Course Code: SEPBCADSCP 4.7 | Credits | 02 |
| Semester | IV | Course Title: Web Programming - Lab | | |

Course Pre-requisites, if any	NA

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:
- Design a webpage to demonstrate different hyperlinks tags.
- Design a webpage to demonstrate nested ordered list.
- Design a webpage for college time table using table tags.
- Write a JS program to accept user data using forms and display it with greeting message.
- Write a PHP program to display prime numbers in given range.

Part A

1. Design a webpage to build a resume using different tags.
2. Design a webpage to create registration form using forms tag.
3. Design a personal webpage to showcase different font properties in CSS.
4. Design a webpage containing paragraphs which showcases span and div tags.
5. Design a webpage to demonstrate custom list using list properties in CSS.
6. Design a webpage to create recipe card using box model in CSS.
7. Design a webpage to add two background images using grading effect in CSS.

Part B

1. JS program to demonstrate keyboard events.
2. JS program to demonstrate switch statement.
3. JS program to demonstrate functions.
4. JS program to demonstrate constructors.
5. PHP program to implement simple calculator operations.
6. PHP program to demonstrate string functions.
7. PHP program to demonstrate different array manipulation function.
8. PHP program to demonstrate message passing mechanism between pages.

Instructions:
- ➢ Certified Journal is mandatory for every student to appear for the examination.
- ➢ Student has to execute all programs in each part to complete the Lab course.
- ➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	II	Course Code: SEPBCADSCP 4.8	Credits	02
Semester	IV	Course Title: Computer Networks - Lab		

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:

- Write a program to implement a basic client-server application using TCP/IP socket programming.
- Write a program to implement a file transfer system between a client and a server.
- Create a simple "ping" program that sends ICMP Echo Request packets to a target and waits for a response.
- Create a simple chat application using the UDP protocol for communication.

Part A (To be implemented using Java)

1. Java Program to find the IP address of a given website specified by the user.
2. Java Program to implement FTP using TCP bulk transfer.
3. Java to implement a GoBack-N ARQ(Automatic Repeat Request) protocol.
4. Java Program to implement simplex Stop-and-Wait protocol.
5. Java program for simulation of error detection code (CRC).
6. Java program to implement Simple Client-Server Communication (TCP) where: The server listens for connections on a port. The client connects and sends a simple text message (e.g., "Hello, Server!"). The server responds with an acknowledgment (e.g., "Hi, Client!").
7. Java client-server program that enables file transfer.
8. Java program to find the shortest path between vertices using bellman-ford algorithm.
9. Java program for congestion control using leaky bucket algorithm.
10. Java program to implement UDP Connection-Less Service using standard ports.

Part B (To be implemented using NS-2 Simulator)

1. TCL Script for connecting two nodes and sending packets in wired network.
2. TCL Script for given STAR topology using SFQ on queue at intermediate node & use different colors for packet originated from different nodes.
3. TCL Script for given RING topology in wired network using For loop & making topology dynamic.
4. TCL Script in wired network for the given topology using TCP connection and sending data through the node.
5. TCL Script in wired network for the given topology using UDP connection and sending data through node.

Instructions:

➢ Certified Journal is mandatory for every student to appear for the examination.
➢ Student has to execute all programs in each part to complete the Lab course.
➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	II	Course Code: SEPBCASECT 4.9 (Skill)		Credits	02
Semester	IV	Course Title: User Interface And User Experience (UI/UX)		Hours	30
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 10		Summative Assessment Marks: 40	Duration of ESA: 02 hrs.		

Course Outcomes	At the end of the course, students will be able to: • Understand UI/UX fundamentals, design thinking principles, and global standards for intuitive user interfaces. • Conduct user research, gather metadata, and create user personas to enhance UX design. • Utilize design tools like Figma and Balsamiq for wireframing, prototyping, and responsive UI design. • Apply color psychology, typography, and layout techniques to improve readability and user engagement. • Develop interactive prototypes, link pages, and create high-fidelity wireframes for application design.

Unit No.	Course Content	Hours
UNIT I	**UI/UX Fundamentals and Design Thinking:** Requirement Gathering: Understanding Business and User needs, Gathering Functional and Non-functional requirements. UI Guidelines, Intuitive UI: Principles of Intuitive Design, Cognitive Load Reduction, Usability Heuristics, Navigation and Information Architecture. Global Standards of UI **Design Thinking:** Understanding the Design Thinking Process Using Real-Life Examples, Design Thinking Steps: Empathy, Define, Ideate, Test, Prototype and Validation	08
UNIT II	**UX and User Persona:** Understand the user, User metadata gathering, User Interview, Stakeholder Interview **Figma & Balsamiq:** Basic Tools in Figma: Introduction to Figma Interface, Components and variants, prototyping features. Layout and Frames: Grid and Layout Design, Auto Layout Features. UI Components: Buttons, Forms, Navigation Bars, UI Design Systems. Mobile Responsiveness: Designing for multiple screen sizes, media queries and adaptive layouts. Wireframing and UI Design: Low-fidelity vs High-fidelity wireframes, converting wireframes into UI designs. Color psychology. Typography: Choosing the right font, readability and legibility, font pairing techniques	12
UNIT III	**Designing an application:** App Idea Generation: Ideation Techniques, concept validation. Requirement Analysis: Business Requirements vs User Needs, feature prioritization.Lo-Fi & Hi-Fi Wireframing: creating Low-Fidelity wireframes for concept testing, High-Fidelity wireframes for final design. Prototype and Linkings: Interactive prototyping in Figma, Linking Pages and Components for Navigation	10

Recommended Leaning Resources

Reference Books:

1. "About Face: The Essentials of Interaction Design" – Alan Cooper
2. "Lean UX: Applying Lean Principles to Improve User Experience
3. Designing and Prototyping Interfaces with Figma: Learn essential UX/UI design principles by creating interactive prototypes for mobile, tablet, and desktop By Fabio Staiano
4. Balsamiq Wireframes Quickstart Guide By Scott Farnello

Year	II	Course Code: SEPBCASECT 4.10 (Elective II)		Credits	02
Semester	IV	Course Title: Personality Development		Hours	30

Course Pre-requisites, if any		NA	
Formative Assessment Marks: 10	Summative Assessment Marks: 40		Duration of ESA: 02 hrs.

Course Outcomes	At the end of the course, students will be able to: • Understand the Concept of Personality • Build Confidence and Self-Esteem • Develop Emotional Intelligence and self Concept • Analyze the determinants of Personality

Unit No.	Course Content	Hours
UNIT I	**Meaning and definition of personality :** Personality development as a process, Importance of pass, Importance of personality development , Theories of Personality, Psychological theory (Signed Freud), Phenomenological theory (CarRogers) Cognitive theory (George A Kelly) A trait factor – Analytic approach(Raymond B. Cattel), Psychosocial development theory(Erickson).	10
UNIT II	**Determinants of Personality:** Physical, intellectual, Emotional, social, educational familial.	10
UNIT III	**The self-Concept:** Individual as a self-sculptor, process of perception cognition and their impact , Learning process, What is attitude, The process of attitude formation.	10

Recommended Leaning Resources

Reference Books:
1. Cloninger, susan C,(2000) Theories of personality, prentice Hall London.
2. Hurloack, Elizabeth B(?) Personality Development.
3. Kagan Jerome (1969), Personality Development , Harcourt Brace, New york.
4. Kundu C.L.(1989) Personality Development , Sterling Bangalore.
5. Personality Development and communication skills, Mulgund&Kenchappanavar, Srhishtiprakashana

Year	II	Course Code: SEPBCASECT 4.10 (Elective II)	Credits	02
Semester	IV	Course Title: Employability Skills	Hours	30

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 02 hrs.

Course Outcomes	At the end of the course, students will be able to: • To fostering positive employee relation and engagement through clear and timely internal communication. • To understanding and adhering to ethical principles in communication practices.

Unit No.	Course Content	Hours
UNIT I	**Introduction:** Meaning, Definition, Process, Elements of Communication, types of communication, Principle of effective Communication, Methods of Communication, Forms of Communication, Evolution and scope of communication , Objectives of Communication - Information ,Advice, order & Instruction, Persuasion, Motivation Education, Warning & Boosting the Morale of Employees.	08
UNIT II	**Methods:** Verbal vs Non-verbal communication, Characteristics of verbal communication ,Characteristics of Non-verbal communication, Business Etiquette Modes : telephone & SMS communication ,Facsimile communication (Fax) computers & E-communication ,video & satellite conferencing, Group discussion, interviews, Presentation, The art of listening, phone Etiquette, Grapevine.	10
UNIT III	**Written Communication:** Needs, functions, component & Layout of Business letters, Drafting of letters - Enquiry Letter, complaints & follow-up Letters, claims, Adjustments, Promotional leaflets and fliers consumer grievance Letter. Application for Employment and Resume, Notice , Agenda , Memo and E-mail Etiquette. Interview-Meaning, types, strategies for success in interview. **Importance of business ethics:** Ethical principles in Communication: honesty, transparency, fairness, accountability, corporate social responsibility (CSR) & its impact on communication.	12

Recommended Leaning Resources

Reference Books:
1. Balan , K.R. and Rayudu C.S (1996) Effective Communication , Beacon New Delhi
2. Bangh , LSue, Fryar, Maridell and Thomas David A. (1998) How to Write First Class Business Correspondence , N.T.C. Publishing Group USA.
3. Bhargva and Bharagav a91971) Company Notices , Meetings and Regulations

Part	Course Code	Subject Name	Teaching Hrs / week	Practical Hrs / week	Examination				Credits
					Exam Duration Hrs	Marks			
						IA	Theory/ Practical	Total	

V Semester BCA w.e.f 2026-27 and onwards

Part	Course Code	Subject Name	Teaching Hrs / week	Practical Hrs / week	Exam Duration Hrs	IA	Theory/ Practical	Total	Credits
Part I DSC#	SEPBCADSCT 5.1	Software Engineering	4	-	3	20	80	100	3
	SEPBCADSCT 5.2	Web Content Management	4	-	3	20	80	100	3
	SEPBCADSCT 5.3	Cyber Security	4	-	3	20	80	100	3
Part II SPEC*	SEPBCASPET 5.4	Data Analytics with R	4	-	3	20	80	100	3
	SEPBCASPET 5.5	C# using .NET Framework	4	-	3	20	80	100	3
	SEPBCASPET 5.6	Full Stack Development	4	-	3	20	80	100	3
	SEPBCASPEP 5.7	Data Analytics with R - Lab	-	4	3	10	40	50	2
	SEPBCASPEP 5.8	C# using .NET Framework - Lab	-	4	3	10	40	50	2
	SEPBCASPEP 5.9	Full Stack Development - Lab	-	4	3	10	40	50	2
Part III SEC Skill	SEPBCASECT 5.10	Practical Knowledge / Skill Gaming And Animation	2	-	2	10	40	50	2
Total			26	12				800	26

DSC : Discipline Specific Courses, SEC : Skill Enhancement Courses SPEC : Specialization.

Note : For the SEPBCASECT 5.10 the semester-end examination will consist of multiple-choice questions.

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Part	Course Code	Subject Name	Teaching Hrs / week	Practical Hrs / week	Exam Duration Hrs	IA	Theory/ Practical	Total	Credits
			VI Semester BCA w.e.f 2026-27 and onwards						
							Examination		
							Marks		
Part I DSC#	SEPBCADSCT 6.1	Data Warehousing and Mining	4	-	3	20	80	100	3
	SEPBCADSCT6.2	Cloud Computing	4	-	3	20	80	100	3
	SEPBCADSCT6.3	Mobile Application Development	4	-	3	20	80	100	3
Part II SPEC*	SEPBCASPET 6.4	Artificial Intelligence & Machine Learning	4	-	3	20	80	100	3
	SEPBCASPEP 6.5	Artificial Intelligence & Machine Learning Lab	-	4	3	10	40	50	2
	SEPBCASPEP 6.6	Project work	-	12	3	60	240	300	10
Part II SEC	SEPBCASECT 6.7	Digital Marketing	2	-	2	10	40	50	2
Total			18	14				800	26

DSC : Discipline Specific Courses, SEC : Skill Enhancement Courses, SPEC : Specialization.

Note : For the SEPBCASECT 6.7 the semester-end examination will consist of multiple-choice questions.

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Year	III	Course Code: SEPBCADSCT 5.1		Credits	03
Semester	V	Course Title: Software Engineering (Theory)		Hours	48
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.		

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand the fundamentals of Software Engineering. • Analyze and compare various SDLC models. • Learn techniques for gathering and documenting functional and non-functional requirements. • Understand the principles of good software design. • Evaluate software testing methodologies.

Unit No.	Course Content	Hours
UNIT I	**Introduction to Software Engineering:** Defining Software, Software Application Domains, Software Engineering Layers, Software Myths. **Process Models:** The Waterfall Model, Incremental process model, Evolutionary Process Model – Prototyping and The Spiral model.	10
UNIT II	**Software Requirement:** Functional and non-functional requirement, Software requirements document, requirements specification. **Requirements Engineering Process:** Requirements elicitation and analysis, requirements validation, Requirements management. **System Models:** Behavioral models, Object Models.	10
UNIT III	**Design Engineering:** Design Concepts, Architectural Styles, Architectural Design. **Modeling Component-level design:** designing class –based components, conducting component-level design. **User Interface Design:** Golden rules, User interface analysis and design	10
UNIT IV	**Testing Strategies:** A strategic approach to software testing, Validation testing, System testing. **Testing Conventional Applications:** White-Box Testing (Basis Path Testing), Black Box Testing (Equivalence Partitioning, Boundary Values Analysis).	08
UNIT V	**Risk management:** Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM plan. **Software Quality Assurance:** Software Reviews, Formal technical Reviews, Statistical Software quality Assurance, Software reliability.	10

Recommended Leaning Resources
Text Books:
1. Ian Somerville, Software Engineering, 9th Edition, Pearson Publication Ltd. 2011 2. Roger Pressman, Software Engineering – A practitioner"s approach 6th edition McGraw Hill 2010.
Reference Books:
1. Carlo Ghejgietal, Fundamentals of software – engineering, Pearson Education. 2. Panakaj Jalote, An Integrated approach to software engineering – Narosa Publishing house.

Year	III	Course Code: SEPBCADSCT 5.2	Credits	03
Semester	V	Course Title: Web Content Management (Theory)	Hours	48

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand content development basics; • Gain Knowledge of tools for multimedia content development for audio/ video, graphics, animations, presentations, screen casting • Host websites and develop content for social media platforms such as wiki and blog • Understand e-publications and virtual reality • Use of e-learning platform Moodle and CMS applications Drupal and Joomla

Unit No.	Course Content	Hours
UNIT I	**Web Content Development and Management:** Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing	10
UNIT II	**Web Hosting and Managing Multimedia Content:** Creating and Maintaining a Wiki Site. Presentation Software Part I, Presentation Software Part II, Screen casting Tools and Techniques, Multilingual Content Development.	10
UNIT III	**Planning and Developing Dynamic Web Content Sites:** Website Design Using CSS Creating and Maintaining a WIKI Site, Creating and Managing a Blog Site	10
UNIT IV	**E- Publication Concept:** E- Pub Tools, Simulation and Virtual Reality Applications, Creating 2D and 3D Animations. Introduction to Moodle, Creating a New Course and Uploading,	10
UNIT V	**Create and Add Assessment:** Add and Enroll User and Discussion Forum, Content Management System: Joomla, Content Management System: Drupal	08

Recommended Leaning Resources

Text Books:
1. Web Content Management: Systems, Features, and Best Practices 1st Edition by Deane Barker. 2. Content Management Bible (2nd Edition) 2nd Edition by Bob Boiko. 3. Moodle for Learning Management System (LMS): A Practical and Visual Guidebook of Administrator and Instructor for Distance Education Paperback – October 12, 2020 by James Koo 4. Using Joomla!: Efficiently Build and Manage Custom Websites 2nd Edition by Ron Severdia

Reference Books:
1. https://onlinecourses.swayam2.ac.in/cec20_lb09/preview

Year	III	Course Code: SEPBCADSCT 5.3		Credits	03
Semester	V	Course Title: Cyber Security (Theory)		Hours	48
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.		

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand cyber-crime, its origin and cyber security privacy issues • To understand various types of cyber-attacks and cyber-crimes • Analyze the threats and risks within context of the cyber security • Evaluate the defensive techniques against these attacks • Understand cyber security act and laws

Unit No.	Course Content	Hours
UNIT I	**Introduction to Cybercrime:** Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime.	09
UNIT II	**Cyber offenses & Cybercrime:** How criminal plan the attacks, Social Engg, Cyber stalking, Cybercafé and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones.	10
UNIT III	**Tools and Methods Used in Cyberline:** Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) **Cybercrimes and Cybersecurity:**	10
UNIT IV	**Understanding Computer Forensics:** Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, The Security/Privacy Threats, Forensics Auditing, Anti Forensics	10

UNIT V	**The Legal Perspectives: Why do we need Cyberlaw:** The Indian Context, The Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment. Cybercrime and the Indian ITA 2000, A global Perspective on cybercrime.	09

Recommended Leaning Resources

Text Books:

1. Sunit Belapure and Nina Godbole, "Cyber Security:

    Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2011, First Edition (Reprinted 2018)

Reference Books:

1. Kennetch J. Knapp, Cyber Security & Global Information Assurance Information Science

Year	III	Course Code: SEPBCASPET 5.4	Credits	03
Semester	V	Course Title: Data Analytics with R (Theory)	Hours	48

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand Data analytics, its types and its applications. • Gain knowledge of R programming fundamental concepts like variables, data types, operators. • Apply the basics in R programming in terms of functions, loops, decision making and data structure. • Design various experiments based on graphs and charts for data visualization in R programming. • Analyze of statistical computations for data analytics.

Unit No.	Course Content	Hours
UNIT I	**Introduction to Data Analytics :** Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.	09
UNIT II	**R Programming Structures:** Overview of R programming, Variables and Data Types, Operators. Control Statements, Looping, Vectors, Arrays, Matrices, List and Data Frames. User defined Functions. Built in Functions: Math Functions, Statistical functions, String functions.	10
UNIT III	**Basic Statistics :** Mean, Median and Mode, Variance and Standard Deviation, Descriptive Analysis, Normal Distribution, T test, Analysis of Variance (ANOVA) Test: One Way & Two Way ANOVA, Regression: Linear and Multiple Linear Regression, Logistic Regression. Time Series Analysis.	10
UNIT IV	**Data Preparation :** Datasets, Importing and Exporting files, Accessing Databases, Data Cleaning and Transformation.	10
UNIT V	**Data handling and Visualization using R:** Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. **Working with R Charts and Graphs:** Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts.	09

Recommended Leaning Resources

Text Books:

1. "Big Data Fundamentals" Thomas Erl, Wajid Khattak,and Paul Buhler:: Concepts, Dribers and techniques , Pearson, Latest Edition
2. "R for Everyone", Jared P Lander, Pearson Education 2017, Latest Edition.
3. R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019.
4. "Beginning R: An Introduction to Statistical Programming"-Larry Pace, Latest Edition".

Reference Books:

1. "Introductory Statistics with R", P Dalgaard, Second edition.
2. "Beginning R-The statistical Programming language", Mark Gardner, John wiley & sons 2012, Latest Edition.
3. "An Introduction to R" , Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version3.0.1 (2013-05-16). URL: https://cran.rproject.org/doc/manuals/r-release/R-intro.pdf

Year	III	Course Code: SEPBCASPET 5.5	Credits	03
Semester	V	Course Title: C# using .NET Framework (Theory)	Hours	48
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.	

Course Outcomes	After the successful completion of the course, the student will be able to: • Describe Object Oriented Programming concepts like Inheritance and Polymorphism in C# programming language. • Interpret and Develop Interfaces for real-time applications. • Build custom collections and generics in C#. • Design and develop GUI based applications in C#.

Unit No.	Course Content	Hours
UNIT I	**C# Language fundamentals:** Introducing the Building Blocks of the .NET Platform(CLR, CTS and CLS). Anatomy of C# program. The System. Environment Class. The System. Console Class, Understanding Value Types and Reference Types, The System Data types, Operators, Decision Constructs, Iteration Constructors, The System.String data types, String Builder, .NET Array Types, Defining Classes and Creating objects, Pillars of OOP, C#'s Inheritance Support, C#'s Polymorphic Support, Understanding C# Partial types, Understanding Boxing and Unboxing Operations.	12
UNIT II	**Object Life time and Exception handling:** Understanding Object Lifetime classes, Objects and References, the basics of Object Lifetime, System.GC typr, Building Finalizable Objects, Building Disposable Objects, Ode to Errors, Bugs and Exceptions, The Role of .NET Exception Handling, throwing generic exceptions, catching exceptions, Configuring the state of an exception, System – Level Exception, Application - Level Exception, Processing Multiple Exception, Generic catch statements, Inner exceptions, Finally Block.	12
UNIT III	**Interfaces, Collections, Delegates & Events:** Defining Interfaces in C#, Implementing an Interface in C#, Contrasting Interfaces to Abstract Base Classes, **Collections:** Introducing Collections, Benefits of Collection Classes, Understanding and using commonly used collections, Interfaces of the System.Collections Namespace, .NET Delegate type, defeining a Delegate in C#, System.Delegate Base Classes, Delegate examples, C# Events.	08
UNIT IV	**GUI using Windows Forms and Database Programming:** Controls-TextBox, label, Button, checkbox, radiobutton, listbox, comboxbox, Datetime picker, Common properties. methods and events, menus, context menus. Menustrip, Graphics and GDI, SDI and MDI, Dialog boxes; Database Programming Understanding the Role of Managed Provider and ADO.NET Objects Connecting to Database. Performing Insert, Update and Delete Operations, Executing Select Statements.	08

UNIT V	**Understanding .NET Assemblies and file handling:** Assemblies-The Role of NET Assemblies, Understanding the format of .NET Assemblies, single file assembly, multifile assembly. Private and Shared Assemblies; File handling: The System IO Namespace, Directory (Info) and File (Info) types, Working with Directory Info, Directory Type, File Info, File Type Classes, Abstract Stream Class, Stream Writers and Stream Readers, String Writers and String Readers, Binary Writers and Binary Readers.	08

Recommended Leaning Resources

Text Books:

1. Andrew Troelsen: Pro C# with .NET 3.0, Special Edition aPress, India, 2007.
2. E. Balagurusamy: Programming in C#. 5th Reprint, Tata McGraw Hill.2004.
3. Herbert Schildt: The Complete Reference C#, Tata McGraw Hill, 2004

Reference Books:

1. C# 2008 programming cogent learning solutions Inc. DreamtechPress.
2. C#2008 Programming covers .net 3.5 Black Book Beginners Edition cogent learning solutions Inc. DreamtechPress.

Year	III	Course Code: SEPBCASPET 5.6	Credits	03
Semester	V	Course Title: Full Stack Development (Theory)	Hours	48

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Design dynamic and interactive web pages and websites. • Run PHP scripts on the server and retrieve results. • Handle databases like MySQL using PHP in Website • Develop applications using object oriented concepts. • Implement advanced web security and Data Optimization techniques.

Unit No.	Course Content	Hours
UNIT I	**Fundamentals of PHP and Web Development:** Introduction to Web Development (Frontend, Backend, Full-Stack), Understanding Client-Server Architecture & HTTP Protocol, Setting up Local Server (XAMPP, WAMP, LAMP), Basics of PHP: Syntax, Variables, Data Types, Control Structures (if-else, switch, loops), Functions in PHP (User-defined , String & Math Built-in)	09
UNIT II	**Advanced PHP Concepts:** String Manipulation & Regular Expressions, PHP Arrays (Indexed, Associative, Multidimensional), Form Handling with PHP (GET, POST), PHP File Handling (Read, Write, Append, Delete), PHP Sessions & Cookies Management, Error Handling & Exception Handling in PHP, Working with Date & Time Functions	09
UNIT III	**MySQL Database & PHP Integration:** Introduction to Databases & MySQL, Setting up MySQL with PHP, Database Design & Normalization Concepts, MySQL Commands (DDL, DML, DCL), Connecting PHP with MySQL using MySQLi , CRUD Operations (Create, Read, Update, Delete), Advanced SQL Queries (Joins, Subqueries, Indexing), Working with Stored Procedures & Triggers, Importing & Exporting Data (CSV, JSON, XML), Sending Emails using PHP (PHPMailer)	10
UNIT IV	**Object-Oriented Programming (OOP) in PHP:** Classes & Objects, Inheritance, Polymorphism, Encapsulation, Static Methods & Properties Password Hashing & Encryption (bcrypt, Argon2), Preventing SQL Injection, XSS, CSRF Attacks, Secure File Upload Handling (Image Uploading), Integrating Third-Party APIs (Payment Gateway, SMS, Email)	09

UNIT V	**Advanced Web Security & Performance Optimization:** User Authentication & Authorization - Role-Based Access Control (RBAC), API Authentication (JWT, OAuth), **PHP Performance Optimization:** Optimizing PHP Code for Speed & Efficiency, Reducing Memory Usage, Using Opcode Caching (APCu, OPcache), Profiling PHP Code (Xdebug, Blackfire). **Database Optimization Techniques** : Query Optimization & Indexing, Using Connection Pooling & Persistent Connections, Caching Database Queries. Working with Web Services & APIs : Consuming RESTful APIs in PHP, Creating APIs with PHP	11

Recommended Leaning Resources

Text Books:

1. PHP A Beginner"s Guide, VIKRAM VASWANI,Tata McGraw-Hill, 2008.
2. The PHP Complete Reference, Steven Holzner –Tata McGraw-HillEdition,2010
3. Spring into PHP5, Steven Holzer, Tata McCraw HillEdition,2005

Reference Books:

1. "PHP and MySQL Web Development" – Luke Welling & Laura Thomson
2. "PHP Objects, Patterns, and Practice" – M. Papantonio & M. Schumacher
3. "The Joy of PHP: A Beginner's Guide" – Alan Forbes
4. "Modern PHP: New Features and Good Practices" – Josh Lockhart
5. "Laravel: Up & Running" – Matt Stauffer

Year	III	Course Code: SEPBCASPEP 5.7	Credits	02
Semester	V	Course Title: Data Analytics with R - Lab		

Course Pre-requisites, if any	NA

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:
- R Program to find Factorial of given number using recursion.
- R program for finding stationary distribution of markanov chains.
- R Program for implementing Quick Sort for Binary Search.
- R Program Generate random numbers from Standard Distribution.
- R Program to check Prime numbers.
- R Program to check Leap year.

Part A

1. R program to Illustrate with if-else statement and how does it operate on vectors of variable length.
2. R program Illustrate with for loop and stop on condition, to print the error message.
3. R Program to implement T-Test for Anova.
4. R Program Compute mean values for vector aggregates defined by factors tapply and sapply.
5. R program to implement different string manipulation functions.
6. R Program Illustrate Reading & Writing Files.
7. R program for any visual representation of an object with creating graphs using graphic functions also demonstrate the legends: Plot(),Hist(),Linechart(),Pie(),Boxplot(),Scatterplots()..

Part B

1. R program for with any dataset containing data frame objects, and employ manipulating and analyzing data.
2. Program to create an application of Linear Regression in multivariate context for predictive purpose.
3. R Program to Find Mean, Mode , Median , Variance and Standard Deviation.
4. R program that performs data cleaning and transformation effectively using a sample dataset. (It covers handling missing values, removing duplicates, renaming columns, filtering, sorting, and adding new columns.)
5. Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.
   a) Find the total number rows & columns
   b) Find the maximum salary
   c) Retrieve the details of the employee with maximum salary
   d) Retrieve all the employees working in the IT Department.
   e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"
6. R program to create a matrix using vectors and perform following operations.
   a) Find transpose of a matrix ii) Find row and column sum of matrix
   b) Find row and column index of maximum and minimum value in the given matrix.
   c) Find sum of principal diagonal elements.
7. R program to create a Data Frame with following details and do the following operations.

itemCode	itemCategory	itemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.

b) Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies"

c) Create another Data Frame called "item-details" with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames.

8. R program to perform time series analysis on the monthly airline passenger dataset (AirPassengers) from 1949 to 1960. The program should:

   a) Visualize the time series data.

   b) Decompose the time series into trend, seasonal, and residual components.

   c) Build a forecasting model using the ARIMA (AutoRegressive Integrated Moving Average) model.

   d) Predict the next 12 months' passenger traffic

Instructions:

➢ Certified Journal is mandatory for every student to appear for the examination.

➢ Student has to execute all programs in each part to complete the Lab course.

➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	III	Course Code: SEPBCASPEP 5.8	Credits	02
Semester	V	Course Title: C# using .NET Framework - Lab		

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:
- Create an application to simulate the working of Font Dialog box using list boxes, label and button controls.
- Program to insert the data in the database having fields such as Roll No, Name, Age and ContactNo using Execute-Non Query.
- Program to input Roll No and display the corresponding student details using database.
- Program to implement Stream Reader and Stream Writer classes.

Part A

1. C# program to show the machine details like machine name. Operating System, Version, Physical Memory and calculate the time since the Last Boot Up. (Hint: Use System. Environment Class)
2. C# Sharp program to calculate roots of Quadratic Equation
3. Program in C# Sharp to count a total number of alphabets, digits and special characters in a string
4. Program in C# Sharp to create a function to calculate the sum of the individual digits of a given number.
5. Draw a square with sides 100 pixels in length. Then inscribe a circle of radius 50 inside the square. Position the square and the inscribed circle in the middle of the screen
6. Program to implement multilevel inheritance.
7. Program to demonstrate System exception.

Part B

1. Object oriented program to demonstrate bank transaction. Include methods for amount deposit, amount withdrawal and display.
2. Program that inputs the coordinates of three mouse clicks from the user and then draws a triangle in the output window using those three points.
3. Demonstrate operator overloading two complex numbers.
4. Program to demonstrate Application exception.
5. Demonstrate Dialog box (Modal and Modeless).
6. Program to demonstrate Directory Info and File Info.
7. Program in C# Sharp to create Menu and menu items.

Instructions:
- ➢ Certified Journal is mandatory for every student to appear for the examination.
- ➢ Student has to execute all programs in each part to complete the Lab course.
- ➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	III	Course Code: SEPBCASPEP 5.9	Credits	02
Semester	V	Course Title: Full Stack Development - Lab		

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:

- Write a program to display current date and time in different formats
- Write a program to create a simple calculator using basic php logic and forms
- Write a PHP script to write content to a file and then read it back
- Write a PHP script to send email using PHP (SMTP, PHPMailer)

Part A

1. PHP program to demonstrate variables, constants, and different data types.
2. Program that takes user input and determines if the number is prime using functions.
3. Program to read and write data to a text file using PHP.
4. PHP script that validates an email ID using regex and performs string operations.
5. Build a simple login form that captures user input using both GET and POST methods.
6. PHP application that implements login functionality using sessions and cookies.
7. Program that demonstrates the use of try-catch blocks and custom exceptions in PHP.
8. PHP script to connect with MySQL and perform Create, Read, Update, and Delete (CRUD) operations.

Part B

1. PHP application that uses Joins, Subqueries, and Prepared Statements for secure database queries.
2. Program to export MySQL data into a CSV file and import data from a JSON file.
3. PHP program using Classes, Objects, Inheritance, and Encapsulation.
4. Develop a user login & registration system with password hashing using bcrypt/Argon2.
5. PHP script to upload images securely with validation and file size restrictions.
6. Build a REST API that allows users to fetch, add, update, and delete records from a MySQL database.
7. PHP program that sends emails using PHPMailer with SMTP authentication.

Instructions:

➢ Certified Journal is mandatory for every student to appear for the examination.
➢ Student has to execute all programs in each part to complete the Lab course.
➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	III	Course Code: SEPBCASECT 5.10		Credits	02
Semester	V	Course Title: Gaming And Animation (Theory)		Hours	30
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 10		Summative Assessment Marks: 40		Duration of ESA: 02 hrs.	

Course Outcomes	At the end of the course, students will be able to: • Understand the basics of Animation and Animation properties in HTML and CSS • Create and apply various effects to animation slides • Understand basics of gaming • Design games, using HTML and JavaScript

Unit No.	Course Content	Hours
UNIT I	**Introduction:** What is an Animation?, HTML5 – SVG ,Viewing SVG Files , SVG Circle , Rectangle, SVG Line SVG Ellipse ,SVG Polygon ,SVG Polyline ,SVG Gradients SVG StarThe Start and End States , Interpolation , Animations in HTML, All About CSS Animations, Creating a Simple Animation ,CSS Animation Property , Reusing Keyframes , Declaring Multiple Animations, Wrap-up, All About CSS Transitions, Adding a Transition ,Looking at Transitions in Detail , The Longhand Properties , Longhand Properties vs. Shorthand Properties, Working with Multiple Transitions, The transition End Even	10
UNIT II	**Sliding Background Effect on Link Hover ,** Overview of How This Works , How this Effect Really Works, Creating a Sweet Content Slider , Overview of How It Works , The Code,The<BLINK>Tag Shall Live On , Re-creating the Blink Effect , Overview of How It Works, Simple Text Fade and Scale Animation , The ExampleMove Element to Click Position , The Example , The Full Code , How This All WorksHover Effects Using Animations , What This Looks Like , Hovering, CSS Animations, and Handoffs	10
UNIT III	**Animations Created in Code,** Why Animate Using JavaScript, Breaking Down a JavaScript Animation , Looking at a Real Example , Going a Little More CrazyMeetrequest AnimationFrame, Meet request Animation Frame ,Using It Another Example ,Your Frame Rate ,Stopping your request Animation Frame LoopVendor Prefixes in JavaScript , Meet the Vendor Prefixes in JavaScript , Dealing with Vendor Prefixes, Animating What You Draw, How This Is All Going to Work , Actually Drawing and Animating on a Canvas , Animating Your Circle. Game IntroGame, CanvasGame, ComponentsGame, ControllersGame, ObstaclesGame, ScoreGame, ImagesGame, SoundGame, GravityGame, BouncingGame, RotationGame, Movement	10

Recommended Leaning Resources

Reference Books:
1. Animation in HTML, CSS, and JavaScript ByKirupaChinnathambi
2. https://www.tutorialspoint.com/html5/index.htm
3. Gaming Section last unit :https://www.w3schools.com/graphics/game_intro.asp
4. https://cloudinary.com/blog/creating_html5_animations

Year	III	Course Code: SEPBCADSCT 6.1		Credits	03
Semester	VI	Course Title: Data Warehousing and Mining (Theory)		Hours	48
Course Pre-requisites, if any		Basics of HTML, CSS, Java Script			
Formative Assessment Marks: 20		Summative Assessment Marks: 80	Duration of ESA: 03hrs.		

Course Outcomes	After the successful completion of the course, the student will be able to: • Introduction to general issues of Data Warehouse and Data Mining. • Understanding of the different architectures and mining techniques • The role and functions of Data Warehouse and Data Mining • Explain the stages and process different data mining techniques. • Learn mining and warehouse techniques through the use of different tools

Unit No.	Course Content	Hours
UNIT I	**Data Warehouse:** Introduction to Data Ware House, Differences between operational data base systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction Transformation-Loading, Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; Fact Less-Facts, OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.	10
UNIT II	**Data Mining:** Motivation for Data Mining, Data Mining Functionalities, Knowledge Discovery Process, Data Mining Techniques, Issues and applications; Data Objects and attribute types, Statistical description of data, **Data Preprocessing:** Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.	08
UNIT III	**Data Cube Technology:** Efficient method for data cube computation, Cube materialization (Introduction to Full cube, Iceberg cube, Closed cube, Shell cube), General strategies for cube computation, Attribute oriented induction for data characterization. **Mining Frequent Patterns:** Frequent patterns, Market basket analysis, Frequent itemsets, closed itemsets, association rules, Types of association rule (Single dimensional, multidimensional, multilevel, quantitative), Finding frequent itemset (Apriori algorithm, FP growth), Generating association rules from frequent itemset, Limitation and improving Apriori, From Association Mining to Correlation Analysis.	10
UNIT IV	**Classification And Prediction :** Definition (Classification, Prediction), Learning and testing of classification, Classification by decision tree induction, ID3 as attribute selection algorithm, Bayesian classification, Laplace smoothing, Classification by backpropagation, Rule based classifier (Decision tree to rules, rule coverage and accuracy, efficient of rule simplification), Support vector machine, Evaluating accuracy (precision, recall, f-measure), Issues in classification.	10

UNIT V	**Clustering Analysis:** Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. **Mining Spatial, Multimedia, Text And Web Data :** Spatial data mining, Spatial data cube, Mining spatial association, Multimedia data mining, Similarity search in multimedia data, Mining association in multimedia data, An introduction to text mining, natural language processing and information extraction, Web mining (Web content mining, Web structure mining, Web usage mining)	10

Recommended Leaning Resources

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.

Reference Books:

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. Introduction to Data Mining, 2nd ed. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar. Pearson Publisher, 2019.

Year	III	Course Code: SEPBCADSCT 6.2	Credits	03
Semester	VI	Course Title: Cloud Computing (Theory)	Hours	48

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Explain the core concepts of the cloud computing paradigm such as how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. • Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost. • Identify resource management fundamentals like resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing. • Analyze various cloud programming models and apply them to solve problems on the cloud.

Unit No.	Course Content	Hours
UNIT I	**Introduction:** Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Applications of Cloud Computing; Trends in Cloud Computing; Leading , Challenges Ahead, Historical Developments, **Different Computing Paradigms:** Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing etc., Comparison of various Computing Technologies; Cloud Platform Service Providers.	10
UNIT II	**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; Virtualization- Definition, Features of Virtualization; Types of Virtualizations- Hardware Virtualization, Server Virtualization, Application Virtualization, Storage Virtualization, Operating System Virtualization; Virtualization and Cloud Computing, Pros and Cons of Virtualization,	10
UNIT III	**Cloud Applications:** Moving Applications to the Cloud –Microsoft Cloud Services Google Cloud Applications –Amazon Cloud Services –Cloud Applications	08
UNIT IV	**Cloud Computing At Work:** Software as a service-overview, driving forces, company offerings, industries, software plus services- overview, mobile device integration, Providers, Microsoft Online.	10
UNIT V	**Cloud Applications:** Scientific Applications- Healthcare (ECG Analysis in the Cloud) Biology (Protein Structure Prediction and Gene Expression Data Analysis for Cancer Diagnosis), Geoscience (Satellite Image Processing); **Business and Consumer Applications:** CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	10

Recommended Leaning Resources

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi: "Mastering Cloud Computing-Foundations and Applications Programming", Elsevier, 2013
2. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
3. Cloud Computing A practical Approach, Anthony T Velte, Toby J Velte,Ph.D. Robert Elsenpeter, McGraw Hill Education(India) Private Limited.
4. K Chandrashekaran: "Essentials of Cloud Computing", CRC Press, 2015
5. A.Srinivasan and J.Suresh, "Cloud Computing –A Practical Approach for Learning and Implementation", Pearson India Publications

Reference Books:

1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.

Year	III	Course Code: SEPBCADSCT 6.3	Credits	03
Semester	VI	Course Title: Mobile Application Development (Theory)	Hours	48

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Being able to build cross platform mobile application development. • Understand the basics of the Dart programming language. • Learn the fundamentals of Flutter widgets. • Learn how to design and build user interfaces with Flutter.

Unit No.	Course Content	Hours
UNIT I	**Introduction to Mobile Applications :** Development, Flutter Introduction: Features of Flutter Advantages of Flutter and Disadvantages of Flutter, Flutter SDK, Android Studio and Creating Simple Hello world Application with flutter, Hot Reload Feature, Basic Flutter Application Structure, Creating Simple Flutter App using Online Sandboxes like FlutLab.io	10
UNIT II	**Dart Programming Language Basics:** Variable declaration and initialization, Constants and final values, **Data Types:** Numeric values, Strings, Boolean Types, Operators, **Flow Control constructs:** if and switch statements, looping statements. Lists and Maps. **Object oriented Programming in Dart:** Defining Classes, Instance Variables and Methods. Named parameters, Arrow functions Constructors, Subclasses.	10
UNIT III	**Introduction to Widgets:** Widgets, Gestures, Concept of State, Layers Widget Build Visualization, Platform Specific Widgets, **Layout Widgets:** Types of Layout Widgets, MaterialApp, Scaffold, Center, Row, Column, Expanded, Align, Container, Padding and Text Widgets, Button, Image and Icon Widgets.	10
UNIT IV	**Introduction to Gestures and State management:** Tap, Double Tap, Long Press, VerticalDrag, Horizontal Drag and Pan. Dialogs, Flutter State Management: Ephemeral State Management, Application State, Navigation and Routing. Stateful Widgets: Input, Checkbox, Radio, Date and Time pickers and ListView	10
UNIT V	**Introduction to Dart Packages and Database Concepts:** Types of Packages and using Dart Package, Database Concepts: SQLite, SQLiteDbProvider object and its methods	08

Recommended Leaning Resources
Text Books:
1. Beginning Android Programming with Android Studio, 4th Edition   Jerome DiMarzio ISBN: 978-1-119-41933- April 2017-Wiley.464 pages 2. Practical Flutter: Improve your Mobile Development with Google's Latest Open-Source SDK By Author Frank Zammett.
Reference Books:
1. https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf 2. https://flutlab.io/ 3. https://zapp.run/ 4. https://www.geeksforgeeks.org/android-tutorial.

Year	III	Course Code: SEPBCASPET 6.4	Credits	03
Semester	VI	Course Title: Artificial Intelligence & Machine Learning (Theory)	Hours	48

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 20	Summative Assessment Marks: 80	Duration of ESA: 03hrs.

Course Outcomes	After the successful completion of the course, the student will be able to: • Understand problems solved by AI, types of intelligent agents • Understand the nature of environment of agents • Application of informed and uninformed searching techniques • Evaluate techniques used for knowledge representation • Analyze supervised and unsupervised machine learning algorithms

Unit No.	Course Content	Hours
UNIT I	**Introduction:** What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, History of AI, intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	10
UNIT II	**Searching:** Searching for solutions: uniformed search strategies – Breadth first search, depth first Search. Informed (Heuristic) Search Strategies, Heuristic Functions **Heuristic search techniques:** A* Search, AO* search Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis Game Playing-Adversarial search, Games, mini-max algorithm	10
UNIT III	**Knowledge representation and Logic Programming:** Representations and mappings, Approaches to knowledge representation, First order logic, predicate logic, Inference in Predicate Logic, semantic nets- frames and inheritance.	08
UNIT IV	**Introduction to machine learning:** Basics of machine learning - Human Learning - Define machine learning - -Applications of machine learning-List the Tools used for machine learning- Advantages and disadvantages of machine learning. Types of machine learning – Supervised Learning, unsupervised, reinforcement **Supervised learning :** **Regression models:** Simple Linear Regression, multiple linear Regression. K-Nearest-Neighbors (KNN), Logistic Regression, Support Vector Machines (SVM) Classification Model-Classification learning Steps - Classification Algorithms - Naive Bayes Classifier, Decision tree - Applications of supervised learning	12
UNIT V	**Unsupervised learning:** Different types of clustering techniques – clustering Algorithms - K-Means Clustering, Hierarchical clustering algorithms - Agglomerative Clustering, Association Algorithm - Apriori algorithm - Applications of Unsupervised learning	08

Recommended Leaning Resources

Text Books:

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013
2. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education
3. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.

Reference Books:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
2. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

Year	III	Course Code: SEPBCASPEP 6.5	Credits	02
Semester	VI	Course Title: Artificial Intelligence & Machine Learning - Lab		

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 03hrs.

Practice Programs:
- Creation and loading different datasets in Python.
- Program to compute Mean, Mode, Median, Variance and Standard deviation using datasets.
- Program to implement minimax algorithm for an application
- Program to analyze students' scores based on study hours using regression.

Part A

1. Program to implement Breadth-First Search(BFS) algorithm.
2. Program to illustrate Depth-First Search (DFS) algorithm.
3. Program to describe A* algorithm.
4. Program to enforce Hill climbing algorithm.
5. Program to perform Tic Tac Toe algorithm.
6. Program to Implement and evaluate a simple linear regression model.
7. Program to Implement a KNN classifier.

Part B

1. Program to execute NaiveBayes algorithm
2. Program to perform decision tree algorithm
3. Program to Implement and visualize K-means clustering.
4. Program to carry out SVM for classification.
5. Program to demonstrate K-means clustering.
6. Program to describe Agglomerative clustering.
7. program to fulfill Apriori algorithm

Note : Programs to be implemented using Python Programming Language

Instructions:
➢ Certified Journal is mandatory for every student to appear for the examination.
➢ Student has to execute all programs in each part to complete the Lab course.
➢ 10 marks of internal assessment (IA) will be awarded based on practical test.

Year	III	Course Code: SEPBCASPEP 6.6	Credits	10
Semester	VI	Course Title: Project work		

Course Pre-requisites, if any	NA

Formative Assessment Marks: 60	Summative Assessment Marks: 240	Duration of ESA: 03hrs.

Objective:

The objective of the BCA project work is to develop a quality software solution by following the software engineering principles and practices. During the development of the project the students shall implement all the stages of the software development life cycle (SDLC).

This Lab will enable students to demonstrate their practical and theoretical skills gained during five semesters of study in BCA Programme

Part A

Instructions

- The students are required to carry out the project in a group of two or three students under the guidance of course teacher.
- Project work problem statement shall be identified by the students with the help of the course teachers and students shall submit the synopsis/project proposal of the same during the second week of the commencement of VI semester BCA course.
- During project development, students are expected to define a project problem, do requirements analysis, systems design, software development, apply testing strategies and do documentation with an overall emphasis on the development of a robust, efficient and reliable software systems.
- No change in the title of the project work shall be allowed after 3rd week of the commencement of VI semester BCA course.
- The project development process has to be consistent and should follow standards identified by the guide monitoring the project work.
- There is no restriction on use of hardware and software for carrying out the project work except that ready application packages are not allowed.
- The students have to submit the individual dissertation of the project work carried out in one hard copy along with soft copy written on compact disc.

Project Dissertation Details:

- The standard procedure for documenting the project work shall be followed. However, while writing is in progress, students shall get each chapter evaluated by to their supervisor for necessary feedback, especially on technical content. Note that the quality of the dissertation is more important than its number of pages.
- The dissertation text (defined as everything except title page, table of contents, references and appendices) should be around 50-70 A4 pages. The length (dissertation text together with appendices) of the dissertation should be less than 100pages.

The students are advised to follow the following typing recommendations

Contents of the dissertation:

Preface: Title page, certificate, student declaration page, abstract, acknowledgement page, contents, list of figures, list of tables, and list of acronyms.

Main chapters:

- **Introduction:** The motivation for the project should be argued here. Then a brief introduction to the project should be provided indicating its objectives and scope. Finally, a paragraph containing an outline of the remaining chapters (starting with Chapter 2) is recommended.
- **Analysis:** information on the existing system should be provided-The students can incorporate different types of diagrams to describe the processes and functionalities of the existing system. The candidate should review software of the proposed system. An analysis of the requirements should

also be provided in this chapter. For example, the requirements of the system could be listed. A specification of the number of users, the frequency of use, and the jobs of the users could be provided. Functional requirements covering system functionality expected by the users should be addressed. Include a section to the end of the analysis chapter to describe the selected methodology.

- **Design:** In this chapter the student should consider different competing design strategies (alternative solutions) for his system. The different strategies may involve the way of development (developing from scratch, using open-source components, etc.,), the development platform (stand-alone personal computer, client-server environment, etc.,), choice of system software (Windows, Linux, etc.). The candidate should compare how the project requirements are satisfied through each alternative. The design of the proposed system should be another major section of this chapter. The candidate should describe the design of the system referring to different types of diagrams/models; for example, if no object oriented methodology has been selected then include use case diagrams, use case narratives, activity diagrams, and entity relationship diagrams, and if object oriented methodology has been selected then include use case diagrams and use case narratives, class diagrams, sequence diagrams. User interface design is the next major section of this chapter. The candidates should describe the design considerations for designing user interfaces of the system and justify the design decisions that were made. Layouts of relevant interfaces should be included in order to clarify the design decisions taken.

- **Implementation:** This chapter should describe the implementation of the system. For example, it should identify and explain all major code and module structures. Include a diagram to depict and describe the interaction between modules of the system. Also, the implementation environment (hardware and software), any existing code that was reused by the candidate, development tools used, and any platform dependence must be discussed. Appropriate technical documentation may be included as appendices to the dissertation if they are expected to be useful for the reader. Note that a list of selected code will appear in appendix and the code used in this chapter should be presented for the purpose of explaining the implementation aspects of selected important code. This code should be presented as a code segment.

- **Evaluation:** A comprehensive test plan that was used to verify and validate the system should be provided. Evidence should be provided of using a wide range of test data. Evidence should be produced to show that all aspects of the system have been tested and specification has been met. Description of the effects of various kinds of errors and the required system behavior upon occurrence of an error should be included. The candidate should report the test results in text in a table in this chapter and include detailed actual test results (in screen shots) in an appendix of the dissertation.

- **Conclusion:** This chapter will conclude the dissertation with a critical evaluation of the system and suggestions for any future work. The evaluation should include a critical discussion and assessment of results of project. This chapter should also identify any deficiencies in the final product and highlight how improvements could be made

- **References:** The details of the references are provided in References section of the dissertation. You should include any web links too.

- **Appendices:** - System Documentation-Provide program installation, compilation and execution details.; Design Documentation- Any design documentation that is not critical to be included in the main text (Chapter 3) but could still be of interest to a reader can be added to the appendices. These could be for example design diagrams (e.g., data flow, entity relationship, database schema and UML) that have not been included in the main text; User Documentation-User documentation may cover all aspects of the system, with appropriate screen shots and explanations; Management Reports- In addition to producing day to day transaction reports (e.g. a payroll system should produce an individual pay sheet, coin analysis to make cash payments, EPF report etc.) a system must produce summarized reports for the management (e.g. monthly, quarterly payments made by

organization, employees, overtime Hrs by employee, etc.). These reports will be included here; - Code Listing; Glossary and Index

Note: Project guidelines shall be notified by the Department at the end of V semester BCA course. The documentation guideline to document the project work in the form of dissertation shall be notified to the students well in advance during VI semester BCA course.

Year	III	Course Code: SEPBCASECT 6.7	Credits	02
Semester	VI	Course Title: Digital Marketing (Theory)	Hours	30

Course Pre-requisites, if any	NA	

Formative Assessment Marks: 10	Summative Assessment Marks: 40	Duration of ESA: 02 hrs.

Course Outcomes	At the end of the course, students will be able to: • Understand the fundamental concepts and principles of digital marketing. • Develop practical skills to implement various digital marketing strategies and techniques. • Analyze and evaluate the effectiveness of digital marketing campaigns. • Apply critical thinking and problem-solving skills to real-world digital marketing scenarios. • Create comprehensive digital marketing plans and strategies.

Unit No.	Course Content	Hours
UNIT I	**Introduction to Digital Marketing:** Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms .Digital Marketing Strategy and Planning: Developing a digital marketing strategy, Budgeting and resource allocation.	10
UNIT II	**Social Media Marketing:** Campaign planning and execution, Social media platforms and their features, Creating and optimizing social media profiles **Content creation and distribution:** Content Creation, Content promotion and amplification. **Email Marketing:** Introduction to email marketing, Building an email list, Email automation and segmentation	10
UNIT III	**Mobile Marketing:** Mobile marketing overview, Mobile app marketing, Location-based marketing Search Engine Optimization: Introduction to SEO, Abstraction of SEO, Types of SEO. **Analytics and Reporting:** Steps and Importance of analytics in digital marketing, Setting up web analytics tools (e.g., Google Analytics), Tracking and measuring key performance indicators (KPIs), Conversion tracking and optimization, Reporting and data visualization	10

Recommended Leaning Resources

Reference Books:
1. Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth.
2. "Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts" by Chad S. White
3. "Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses" by Joe Pulizzi
4. "Mobile Marketing: How Mobile Technology is Revolutionizing Marketing, Communications and Advertising" by Daniel Rowles
5. "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik

Scheme of Evaluation
Semester End Exam Question Paper Pattern

Duration of the examination: 3hour Max. Marks: 80

Section A

Answer any TEN Questions from the following, each carries 2 marks: [10X2=20]
1. --------------------------------------
2. --------------------------------------
3. --------------------------------------
4. --------------------------------------
5. --------------------------------------
6. --------------------------------------
7. --------------------------------------
8. --------------------------------------
9. --------------------------------------
10. --------------------------------------
11. --------------------------------------
12. --------------------------------------

Section B

Answer any FOUR from the following questions each carries 5 marks. [4X5=20]
13. --------------------------------------
14. --------------------------------------
15. --------------------------------------
16. --------------------------------------
17. --------------------------------------

Section C

Answer any FOUR from the following questions each carries 10 marks. [4X10=40]
(The Question may consists two sub-questions)
18. --------------------------------------
19. --------------------------------------
20. --------------------------------------
21. --------------------------------------
22. --------------------------------------

CIA for Practical	
Assessment Type	Marks
Test1	10
Total	10 Marks

Semester End Examination Scheme of Evaluation for Lab Examination

Assessment Criteria	Marks
Writing of 2 Programs (Each from Part A & Part B)	15
Execution (Includes program code modification and execution result)	15
Journal	05
Viva Voice	05
Total 40 Marks	40 Marks

Instructions:
1. Certified Journal is mandatory for appearing in the Lab examination.
2. Students shall be given two programming assignments taking into consideration the duration of the time allotted to students for writing, typing and executing the programs.

CIA for Theory	
Assessment Type	Marks
Test 1 / Seminar / Activity	10
Test 2 / Seminar / Activity	10
Total	20 Marks

Note: Guidelines given by the university from time-to-time shall be followed for IA.

CIA for Project Work	
Assessment Type	Marks
First Internal Assessment	30
Second Internal Assessment	30
Total	60 Marks

First Internal Assessment   Max.Marks: 30   Time: 20 minutes

Students shall present the details of the project work carried out that includes the following
- Synopsis contents
- Problem identification and proposed solution
- SAD, SRS
- Database Design
- Functions

PowerPoint slides shall be used by the students to present the work carried out.

Second Internal Assessment   Max. Marks: 30   Time: 30minutes

Students shall present the details of the project work carried out that includes the following
- Coding details
- Forms and reports
- Demo of the application developed

Note: IA marks shall be assigned by the concerned guide monitoring the project work of the students.

Semester End Examination Scheme of Evaluation for Project Work.

Assessment Criteria	Marks
Dissertation/Project Report evaluation	100
Presentation/Demo of the application developed : (navigation of the application, features incorporated, data validation, UI, reports, etc.)	100
Viva Voice	40
Total	240 Marks

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