

B.C.A. (Honours) & B.C.A. (Honours with Research)
(Semester - 3 and Semester - 4)
Saurashtra University
To be effective from June – 2024

B.C.A. (Semester – 4)

Sr. No.	Type of Course	Course Title	Credit
1	MAJOR	CS-22: Programming with Java	4
2	MAJOR	CS-23: Programming with C#	4
3	MAJOR	CS-24: Operating Systems Concepts with Unix/Linux	4
4	MINOR	CS-25: Practical Based on CS-22, CS – 23, CS-24	4
5	AEC	CS-26: Fundamentals of IoT	2
6	SEC	CS-27: Web Searching Technology and Optimization	2
7	VAC	CS-28: Digital Empowerment	2
Total Credits of Semester 4			22

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CS-22: Programming with Java		
Objectives:		
<ul style="list-style-type: none"> • To provide fundamental concepts of Object-Oriented Programming and familiar with Java environment and its applications. • To be able to understand control structures, classes, methods and argument passing and iteration graphical user interface basics programming and documentation style. 		
Prerequisites:		
<ul style="list-style-type: none"> • Basic knowledge of object-oriented approach in programming with basic skills using Java. 		
Unit No.	Topic	Detail
1	History, Introduction and Language Basics, Classes and Objects	<ul style="list-style-type: none"> • History and Features of Java • Java Editions • JDK, JVM and JRE • JDK Tools • Compiling and Executing basic Java Program • Java IDE (NetBeans and Eclipse) • Data Type (Integer, Float, Character, Boolean) • Java Tokens: Keyword, Literal, Identifier, Whitespace, Separators, Comments, Operators: • Operators: Arithmetic, Relational, Boolean Logical, Bitwise Logical, Assignment, Unary, Shift, Special operators • Java Keywords (assert, strictfp, enum) • Type Casting - Decision Statements (if, switch) • Looping Statements (for, while, do..while) • Jumping Statements (break, continue, return) • Array (One Dim., Rectangular, Jagged) • Command Line Argument Array
		<ul style="list-style-type: none"> • OOP Concepts (Class, Object, Encapsulation, Inheritance, Polymorphism) • Creating and using Class with members • Constructor • finalize() method • Static and Non-Static Members • Overloading (Constructor & Method) • Varargs, IIB (Instance Initialization Block) in Java

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2	Inheritance, Java Packages	<ul style="list-style-type: none"> • Universal Class (Object Class) • Access Specifiers (public, private, protected, default, private protected) • Constructors in inheritance • Method Overriding • Interface, Object Cloning, • Nested and Inner Class • Abstract and Final Class • Normal import and Static Import • Introduction to Java API Packages and imp. Classes <ul style="list-style-type: none"> o java.lang, o java.util o java.io, o java.net o java.awt, o java.awt.event o java.applet, o java.swing • java.lang Package Classes (Math, Wrapper Classes, String, StringBuffer) • java.util Package Classes (Random, Date, GregorianCalendar, StringTokenizer, Collection in Java) • Vector, HashTable, LinkedList, SortedSet, Stack, Queue, Map • Creating and Using UserDefined package and sub-package
3	Exception Handling, Threading and Streams (Input and Output)	<ul style="list-style-type: none"> • Introduction to exception handling • try, catch, finally, throw, throws • Creating user defined Exception class - Thread and its Life Cycle (Thread States) • Thread Class and its methods • Synchronization in Multiple Threads (Multithreading) • Deamon Thread, Non-Deamon Thread <hr/> <ul style="list-style-type: none"> • Stream and its types (Input, Output, Character, Byte) • File and RandomAccessFile Class • Reading and Writing through Character Stream Classes (FileReader, BufferedReader, FileWriter, BufferedWriter) • Reading and Writing through Byte Stream Classes (InputStream, FileInputStream, DataInputStream, OutputStream, FileOutputStream, DataOutputStream) • StringTokenizer Class • Piped Streams, Bridge Classes: InputStreamReader and OutputStreamWriter • ObjectInputStream, ObjectOutputStream
4	JavaFx Basics and	<ul style="list-style-type: none"> • Basic Structure of JAVA FX program,

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	Event-driven programming and animations	<ul style="list-style-type: none"> • Panes, • UI Control and Shapes, • Property binding, • the Color and the Font class, • the Image and Image-View class, • layout panes and shapes, • Events and Events sources, • Registering Handlers and Handling Events, • Inner Classes, anonymous inner class handlers, • mouse and key events, • listeners for observable objects, • animation
5	JavaFx UI controls and multimedia	<ul style="list-style-type: none"> • Labeled and Label • Button • Checkbox • Radiobutton • Textfield • Textarea • Combobox • Listview • Scrollbar • Slider • Video and Audio

Seminar	-	5 Lectures
Expert Talk	-	5 Lectures
Test	-	5 Lectures

Total Lectures 60 + 15 = 75

Reference Books:

- Java: A Beginner's Guide – Jul 2014 by Herbert Schildt
- Java Programming (Oracle Press) by Poornachandra Sarang
- Java The Complete Reference, 8th Edition – by Herbert Schildt
- Ivor Horton's "Beginning Java 2" JDK 5 Edition, Wiley Computer Publishing.
- Ken Arnold, James Gosling, David Holmes, "The Java Programming Language", Addison-Wesley Pearson Education
- JavaFx A Beginners Guide by J. F. DiMarzio, McGraw Hill Computing
- Getting Started with JavaFx by Oracle:
<https://docs.oracle.com/javase/8/javafx/JFXST.pdf>
- James Gosling, Bill Joy, Guy Steele, Gilad Bracha, "The Java Language Specifications", Addison-Wesley Pearson Education (3rd edition) Download at
<http://docs.oracle.com/javase/specs/>

Course outcomes:

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- Understand basic concepts and Java Programming Constructs
- Demonstrate Object Oriented Programming Concepts using JAVA
- Develop robust application by demonstrating professionally acceptable coding
- Design attractive user interface using AWT

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CS-23: Programming with C#		
Objectives: <ul style="list-style-type: none"> Demonstrate knowledge of object-oriented concepts design, user experience and functional requirements C# .Net Application. Prerequisites: <ul style="list-style-type: none"> Basic knowledge of C# programming language and .Net environment. 		
Unit No.	Topic	Detail
1	.NET Framework, and Visual Studio IDE, Language Basics	<ul style="list-style-type: none"> Introduction to .Net Framework Features / Advantages CLR, CTS and CLS BCL / FCL / Namespaces Assembly and MetaData JIT and types Managed Code and Unmanaged Code Introduction to .NET Framework and IDE versions Different components (windows) of IDE Types of Projects in IDE: Console, Windows, Web, Setup, etc. Data Types: Value Type & Reference Type Boxing and UnBoxing Operators: Arithmetic, Relational, Bitwise, etc. Arrays: One Dimensional, Rectangular, Jagged Decisions: If types and switch case Loops: for, while, do..while, foreach
2	Class and Inheritance, Property, Indexer, Pointers, Delegates, Event, Collections	<ul style="list-style-type: none"> Concept of Class, Object Encapsulation, Inheritance, Polymorphism Creating Class and Objects Methods with “ref” and “out” parameters Static and Non-Static Members Constructors Overloading Constructor, Method and Operator Inheritance Sealed Class & Abstract Class Overriding Methods Interface inheritance Creating and using Property Creating and using Indexer Creating and using Pointers (unsafe concept) Creating and using Delegates (Single / Multicasting) Creating and using Events with Event Delegate Collections: Array, List, HashTable, Stack, Queue, SortedList

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		and their differences.
3	Windows Programming	<ul style="list-style-type: none"> • Creating Windows Application • MessageBox class with all types of show() method • Basic Introduction to Form and properties • Concept of adding various Events with event parameters • Different Windows Controls <ul style="list-style-type: none"> ○ Button, ○ Label ○ TextBox, ○ RadioButton ○ CheckBox, ○ ComboBox ○ ListBox, ○ PictureBox ○ ScrollBar, ○ TreeView • Menu: MenuStrip, ContextMenuStrip, ToolStrip <ul style="list-style-type: none"> ○ Timer ○ Panel and GroupBox • Dialog Boxes <ul style="list-style-type: none"> ○ ColorDialog, ○ FontDialog, ○ SaveFileDialog ○ OpenFileDialog • MDI Concept with MDO Notepad • Concept of Inheriting Form
4	Database Programming with ADO .NET	<ul style="list-style-type: none"> • Concept of Connected and Disconnected Architecture • Data Providers in ADO.NET • Connection Object • Connected Architecture: <ul style="list-style-type: none"> ○ Command, ○ DataReader • Disconnected Architecture: <ul style="list-style-type: none"> ○ DataAdapter, ○ DataSet, ○ DataTable, DataRow, DataColumn, • DataRelation, DataView Data Binding • GridView Programming

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5	User Controls (Components), Crystal Reports, Setup Project	<ul style="list-style-type: none"> • Creating User Control with Property, Method, Event • Using User Control in Windows, • Creating Crystal Reports , Types of Reports • Report Sections • Formula, Special Field and Summary in Report • Types of Setup Projects • Creating Setup Project
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Seminar - 5 Lectures

Expert Talk - 5 Lectures

Test - 5 Lectures

Total Lectures 60 + 15 = 75

Reference Books:

- Pro C# 5.0 and .NET 4.5 Framework (By: Andrew Troelse)
- Head First C# - (By: Jennifer Greene, Andrew Stellman)
- C# 5.0 Unleashed – (By: Bart De Smet)
- Adaptive Code Via C# - (By: Gary McLean Hall)
- C# .NET Programming Black Book – Steven Holzner – Dreamtech Publications
- Introduction to .NET Framework – Wrox Publication
- Microsoft ADO .NET – Rebecca M. Riordan, Microsoft Press

Course outcomes:

- Use the Microsoft Visual Studio development environment to create a windows application
- Understand the basics of object-oriented programming, CLR and .NET framework
- Demonstrate C# programming constructs to solve given problem
- Perform CRUD operations in windows application
- Use the trace and debug utility that are provided with Visual Studio .NET
- Develop, configure and deploy windows application

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CS-24: Operating Systems Concepts with Unix / Linux		
Objectives:		
<ul style="list-style-type: none"> • To provide the basic feature, function and interface with the hardware and application software to run the computer smoothly. 		
Prerequisites:		
<ul style="list-style-type: none"> • Basic knowledge of operating system and it's functionality along with its types 		
Unit No.	Topic	Detail
1	Introduction, Process and Thread, Process Scheduling	<ul style="list-style-type: none"> • Meaning of OS • Functions of OS • Features of OS • OS Types (User Point of View) • OS Types (Features Point of View)
		<ul style="list-style-type: none"> • Process Definition • Process States • Process State Transitions • Process Control Block • Context Switching • Threads <ul style="list-style-type: none"> ○ Concept of multithreads ○ Benefits of threads ○ Types of threads
		<ul style="list-style-type: none"> • Types of Schedulers • CPU Scheduling Algorithms • FCFS • SJN • Round Robin • Priority Base Non-Preemptive • Priority Base Preemptive
2	Deadlocks, Memory Management	<ul style="list-style-type: none"> • Deadlocks: Definition • Deadlock Prevention • Deadlock Avoidance • Deadlock Detection • Physical Memory and Virtual Memory • Memory Allocation • Internal and External fragmentation • Contiguous Memory Allocation • Noncontiguous Memory Allocation • Virtual Memory Using Paging • Virtual Memory Using Segmentation

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3	Getting Started with Unix, Unix Shell Command	<ul style="list-style-type: none"> • Unix Architecture • Unix Features • Types Of Shell (C, Bourn, Korn) • Unix File System • Types Of Files <ul style="list-style-type: none"> ○ Ordinary Files ○ Directory Files ○ Device Files • Unix File & Directory Permissions
		<ul style="list-style-type: none"> • Connecting Unix Shell : Telnet • Login Commands passwd, logout, who, who am i, clear,uname • File / Directory Related Command ls, cat, cd, pwd, mv, cp, ln, rm, rmdir, mkdir, chmod, chown, chgrp, find, more, less, head, tail, wc, touch, stat, alias, type • Operators in Redirection & Piping <, >, <<, >>, • Finding Patterns in Files grep, fgrep, egrep • Working with columns and fields cut, paste, join • Tools for sorting :sort, uniq • Comparing files : cmp, comm, diff • Changing Information in Files: tr, sed • Examining File Contents : od • Tools for mathematical calculations: bc, factor • Monitoring Input and Output :tee, script • Tools For Displaying Date and Time: cal, date • Communications : telnet, ping • Process Related Commands: ps, sleep
4	Text Editing with vi and nano Editor, Shell Programming	<ul style="list-style-type: none"> • Introduction of vi editor • Modes in vi • Switching mode in vi • Cursor movement • Screen control commands • Entering text, cut, copy, paste in vi editor • Introduction of nano editor
		<ul style="list-style-type: none"> • Shell Keywords • Shell Variables • System variables PS2, PATH, HOME,LOGNAME, MAIL, IFS, SHELL, TERM, MAILCHECK

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		<ul style="list-style-type: none"> • User variables set, unset and echo command with shell variables • Positional Parameters • Interactive shell script using read and echo • Decision Statements <ul style="list-style-type: none"> o if then fi o if then else fi o if then elif else fi o case esac • test command • Logical Operators • Looping statements <ul style="list-style-type: none"> o for loop o while loop o until loop o break, continue command • Array • Function • Various shell script examples
5	Getting Started with Linux, Linux Booting, Linux Admin (Ubuntu)	<ul style="list-style-type: none"> • History of Linux • GNU, GPL Concept • Open Source & Freeware • Structure and Features of Linux • Installation and Configuration of Linux <ul style="list-style-type: none"> o Using with Ubuntu • Startup, Shutdown and boot loaders of Linux
		<ul style="list-style-type: none"> • Linux Booting Process <ul style="list-style-type: none"> o LILO Configuration o GRUB Configuration
		<ul style="list-style-type: none"> • Creating Linux User Account and Password • Installing and Managing Samba Server • Installing and Managing Apache Server • Configure Ubuntu's Built-In Firewall • Working with WINE

Seminar - 5 Lectures
Expert Talk - 5 Lectures
Test - 5 Lectures

Total Lectures 60 + 15 = 75

Reference Books:

- Operating System Concept, Abraham Silberschatz, Peter B. Galvineg Gagne, Wiley-Indian Edition, 9th Edition

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- Operating Systems, Internals and Design Principles, William Stallings, Seventh Edition
- Unix Shell Programming – Y. Kanetkar – Bpb Publications
- Unix Concepts and Applications – Sumitabha Das
- The complete reference Linux, Richard Petersen, McGraw Hill, Sixth Edition

Course outcomes:

- Understand design and implementation aspects of modern operating system
- Acquire knowledge of four major OS components: process management, memory management, file systems, and input/output mechanisms
- Analyze and compare various process scheduling algorithms
- Learn the concepts, design, and structure of the UNIX operating system
- Design shell scripts using various UNIX utilities

Hands-On (Not to be asked in the examination):

- Installation of Unix / Linux
- User and Group Creation
- Demo of Various Applications available in Unix / Linux like Star Office, Games and other productivity tools
- Demo of GNOME, KDE Desktops in Linux

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CS-25: Practical Based on CS-22, CS – 23, CS-24	
<p>Objectives:</p> <ul style="list-style-type: none"> • To apply theoretical concepts through practical applications. • To develop practical skills in various aspects of JAVA, C# .Net and Shell Scripting <p>Prerequisites:</p> <ul style="list-style-type: none"> • Knowledge of Object Oriented Programming • Knowledge of DBMS • Knowledge of computer operating 	
<p>CCE- Continuous and comprehensive Evaluation as follow</p> <ul style="list-style-type: none"> • The continuous Comprehensive Evaluation (CCE) for each subject will be conducted by the teacher of that subject. The teacher will decide how the evaluation will be done. Usually CCE includes things like class participation, case studies and presentation, assignments, tutorials, small test (announced or surprised), quizzes and attendance or a mix of these. • Students must submit their work for internal evaluation on time to time. • Another part of CCE is the mid-term exam, which is compulsory for all students. This exam will be conducted internally by the college. 	50 Marks
<p>SEE – Semester End Examination as per the following</p> <ul style="list-style-type: none"> • Practical Exam is conducted by college using approved examiners (3 Hours duration) • Students must prepare a practical notebook/book for the final practical examination. (The practical book serves as a record of all practical work, observations, procedures and results performed during the semester in lab. It is essential for evaluation during the final practical examination) 	50 Marks

CS-25: Practical Based on CS-22, CS – 23, CS-24	Total Marks - 100	
Topics	CCE	SEE
<p>CS-22 Practically implementation of Java Program which includes: Java Array, Command Line Argument Array, OOP concepts, Java Access Specifiers and Inheritances, IIB and VARARGs in JAVA, Java Packages, Exception Handling , Threading , Classes of JavaFx, JavaFx UI Controls, JavaFx Listeners, Event Handlers, JavaFx Multimedia</p>	20	20
<p>CS-23 Practically implementation of C# program which includes: Jagged Array, Keywords in C# (Ref, out), Indexers, Delegates, Collections, Windows Controls, Dialog Controls, MDI Form, Connected Architecture, Disconnected Architecture</p>	20	20

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CS-24 Unix Shell script which includes: Redirection and piping, File and directory related command, Finding Pattern in Files, Positional Parameters, Decision, Looping Statements in Script, Logical Operators in Script	10	10
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Course Outcomes:

- Able to get knowledge about a comprehensive understanding of Object Oriented Programming and their features.
- Student will get practical skills in GUI Development, clear the basics of OS, and implementation of shell scripting too.

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CS – 26 FUNDAMENTALS OF IoT		
<p>Objectives:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts and principles of the Internet of Things. • Explore the architecture, components and technologies used in IoT systems. • Learn about different communication protocols and standards for IoT. • Gain insights into the design considerations and challenges in developing IoT solutions. • Acquire practical skills in designing and implementing IoT systems. <p>Prerequisites:</p> <ul style="list-style-type: none"> • Basic knowledge of computer networks and protocols • Familiarity with programming languages such as C / C++ 		
Unit No.	Topic	Detail
1	Introduction to IoT	<ul style="list-style-type: none"> • Introduction to the Internet of Things (IoT) • History and Evolution of IoT • Key Concepts and Definitions • Applications and Use Cases of IoT • Challenges and Opportunities in IoT
2	IoT Architecture and Technologies	<ul style="list-style-type: none"> • Conceptual Framework • IoT Architecture Overview • Technology behind IoT • Sources of the IoT • M2M Communication • IoT Examples
3	Hardware for IoT	<ul style="list-style-type: none"> • Sensors • Digital Sensors • Actuators • Radio Frequency Identification (RFID) Technology • Wireless sensor networks • Overview of IoT supported Hardware platforms: <ul style="list-style-type: none"> ○ Arduino ○ Netduino

Seminar - 5 Lectures
 Expert Talk - 5 Lectures
 Test - 5 Lectures

Total Lectures 30 + 15 = 45

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Reference Books:

- “Internet of Things (A Hands-on Approach)” b Arshdeep Bahga and Vijay Madisetti
- “Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry” by Maciej Kranz
- “Designing Connected Products: UX for Consumer Internet of Things” by Claire Rowland, Elizabeth Goodman, Martin Charlier, Ann Light, and Alfred Lui

Course Outcomes:

- Explain the concept and significance of the Internet of Things in various domains.
- Describe the architecture and components of IoT systems, including sensors, actuators, and communication protocols.
- Analyze different IoT communication protocols and select appropriate protocols for specific IoT applications.
- Identify design considerations and challenges in developing scalable and secure IoT solutions.

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CS – 27 WEB SEARCHING TECHNOLOGY AND OPTIMIZATION		
<p>Objectives:</p> <ol style="list-style-type: none"> 1. Understand basic of search engines and reflecting 2. Understand SEO objectives and defining site audience. 3. Apply and Implement SEO friendly website with all SEO concept. 4. Understand keyword research and apply it for website developments. 5. Understand the new trends of digital technologies. <p>Prerequisites: Basic knowledge of SEO, search engine and E-commerce.</p>		
No	Topics	Details
1	Search Engine Basics and Understanding SEO Objectives	<ul style="list-style-type: none"> • The Mission of Search Engines & Market Share • Human Goals of Searching & Determining Searcher Intent • How People Search & How Search Engines Drive Commerce • Eye Tracking & Click Tracking: Natural vs. Paid • Understanding Search Engine Results & Algorithm-Based Ranking Systems • Determining SEO Objectives & Setting Goals • Understanding Audience & Finding Niche • Maior Elements of Planning & Identifving Competitors
2	Implementing SEO-friendly Website	<ul style="list-style-type: none"> • Making Site Accessible to Search Engines • Creating Optimal Information Architecture • Root Domains, Subdomains, and Microsites • Optimization of Domain Names/URLs & Keyword Targeting • Content Optimization & Duplicate Content Issues • Controlling Content with Cookies and Session IDs • Content Delivery and Search Spider Control • Redirects & Content Management System (CMS) Issues • Optimizing Flash & Best Practices for Multilanguage/Country Targeting
3	Keyword Research and Tracking Results	<ul style="list-style-type: none"> • Theory Behind Keyword Research & Traditional Approaches • Site Content Analysis & Keyword Research Tools • Determining Keyword Value & Leveraging the Long Tail • Opportunities in Vertical Search & Optimizing for Different Types • Tracking Results & Measuring Success • Measuring Search Traffic & Tying SEO to Conversion and ROI • Competitive and Diagnostic Search Metrics • Performance indicators for Long Tail SEO & Future Trends in SEO

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Seminar	- 5 Lectures
Expert Talk	- 5 Lectures
Test	- 5 Lectures

Total Lectures 30 + 15 = 45

Course outcomes:

- Understand the main elements that help a website rank organically and in the paid search space in Google.
- Learn how to perform keyword research using Google's free tools.
- Learn how to develop landing pages that are search engine friendly.
- Learn how to carry out inbound linking practices.

Reference Books:

- The Art of SEO : Mastering Search Engine Optimization By Eric Enge, Stephan Spencer, Rand
- Fishkin, Jessie C Stricchiola, O'Reilly Media, 3rd Edition October, 2015
- Google SEO Bible, Beginner's Guide to SEO, ISBN-978-1700098733, moamI mohammed, 2019
- SEO Warrior: Essential Techniques for Increasing Web Visibility By JohnI Jerkovic, O'Reilly Media, November, 2009

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CS – 28 Digital Empowerment		
Objectives: <ul style="list-style-type: none"> • Understand the digital world and need for digital empowerment • Create awareness about Digital India • Explore, communicate and collaborate in cyberspace • Building awareness on cyber safety and security Prerequisites: <ul style="list-style-type: none"> • Basic computer literacy and familiarity with Operating System.. 		
Unit No.	Topic	Detail
1	Digital Inclusion and Digital Empowerment	<ul style="list-style-type: none"> • Needs and Challenges • Vision of Digital India: <ul style="list-style-type: none"> ○ DigiLocker ○ E-Hospitals ○ E-Pathshala ○ SHIM ○ E-Kranti (Electronic Delivery of Services) ○ e-Health Campaigns • Public utility portals of Govt. of India such as RTI, Health, Finance, Income Tax filing, Education
2	Communication and Collaboration in the Cyberspace	<ul style="list-style-type: none"> • Electronic Communication: electronic mail, blogs, social media • Collaborative Digital platforms • Tools / Platforms for online learning • Collaboration using file sharing, messaging, video conferencing
3	Towards Safe and Secure Cyberspace	<ul style="list-style-type: none"> • Online security and privacy • Threats in the digital world: Data breach and Cyber Attacks • Blockchain technology • Security Initiatives by the Govt. of India

Seminar - 5 Lectures
 Expert Talk - 5 Lectures
 Test - 5 Lectures

Total Lectures 30 + 15 = 45

Suggested Books, References and Online Resources

- David Sutton, “Cyber Security: A Practitioner’s guide”, BCS Learning & Development Limited, UK, 2017
- <https://www.mha.gov.in/document/downloads/cyber-safety-handbook>
- Rodney Jones and Christoph Hafner – “Understanding digital Literacies: A practical Introduction”, Routledge Books, 2nd Edition, 2021.

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- <https://www.digitalindia.gov.in>
- <https://www.digilocker.gov.in>
- <https://www.cybersafeindia.in>
- <https://www.meity.gov.in/cyber-suraskshit-bharat-programme>

Course Outcomes:

- Use digital services in daily life.
- Develop skills to communicate and collaborate in cyberspace using social platforms, teaching / learning tools.
- Understand the significance of security and privacy in the digital world.
- Evaluate ethical issues in cyber world.

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BCA SEM- 4

CS-23 Programming with C#

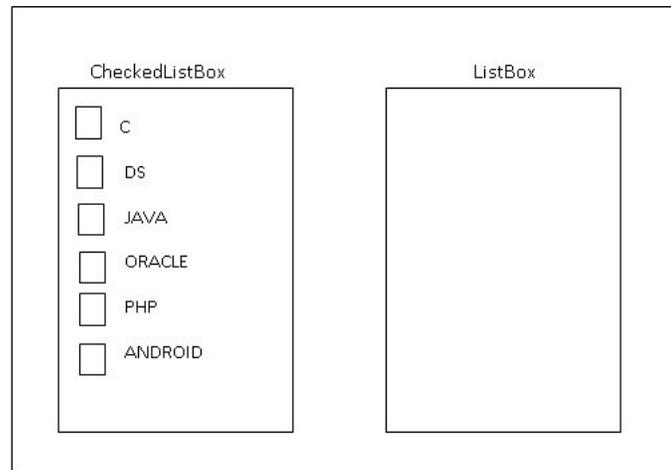
Minimum following exercise should be performed by the students during the semester

- (1) Write a program to swap two numbers using arithmetic operators.
- (2) Find the sum, difference, product, and quotient of two numbers.
- (3) Use relational operators to compare two numbers and display the result.
- (4) Use if-else to check if a number is positive, negative, or zero.
- (5) Use nested if statements to find the largest among three numbers.
- (6) Implement switch-case to print day of the week based on number input.
- (7) Write a program using for loop to print first 10 natural numbers.
- (8) Write a program using while loop to print even numbers up to 50.
- (9) Write a program using do-while loop to accept numbers until zero is entered.
- (10) Write a C# program to generate following series:
 - a. 1 2 3.....n
 - b. 1 3 5.....n
 - c. 2+4+6.....n
 - d. 1+4+7.....n
 - e. 0 1 1 2 3 5.....n
 - f. 1 2 2 4 8.....n
- (11) Find the factorial of a number using loops.
- (12) Calculate the sum of digits of a given number.
- (13) Create a program to check if a number is palindrome.
- (14) Implement a program to find prime numbers between 1 and 100.
- (15) Use foreach loop to iterate over an array of strings.
- (16) Create and display elements of a one-dimensional array.
- (17) Create and display elements of a two-dimensional rectangular array.
- (18) Create and display elements of a jagged array.
- (19) Write a program to count vowels and consonants in a string.
- (20) Create a program to reverse a string using loops.
- (21) Write a program to merge two arrays.
- (22) Write a program to remove duplicates from an array.
- (23) Write a program to find the second largest element in an array.
- (24) Create a jagged array of student marks and calculate average.
- (25) Sort an array using bubble sort.
- (26) Sort an array using selection sort.
- (27) Use conditional operator (? :) to find maximum of two numbers.
- (28) Implement nested switch-case to handle multi-level menu options.
- (29) Write a program to simulate a simple calculator using loops and switch.
- (30) Write a program to check leap year using if conditions.
- (31) Write a program that uses break and continue statements inside loops.
- (32) Create a class Student with properties and methods and generate details of the 3 students and display it.

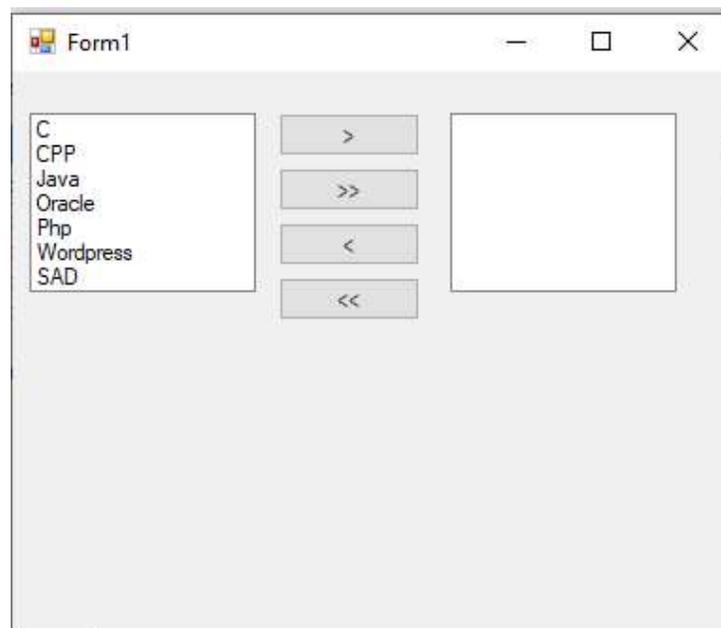
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- (33) Implement encapsulation by making class members private and using properties.
- (34) Create constructors (default and parameterized) in a class.
- (35) Demonstrate constructor overloading.
- (36) Create a class with method overloading.
- (37) Implement operator overloading for + operator in a ComplexNumber class.
- (38) Create a base class Person and derive Student and Teacher classes.
- (39) Demonstrate method overriding using virtual and override keywords.
- (40) Create an abstract class Shape and derive Circle and Rectangle classes.
- (41) Create multicast delegate and combine multiple methods.
- (42) Create event handlers and trigger events on property change.
- (43) Create a class hierarchy with multiple levels of inheritance.
- (44) Demonstrate polymorphism by calling overridden methods.
- (45) Use List<T> collection and perform add, remove, search, and sort.
- (46) Create a Windows Forms app with a Button and display a MessageBox on click.
- (47) Create a form with TextBox to accept user input and display it on a Label.
- (48) Create a simple calculator using buttons and TextBoxes.
- (49) Create a form that changes background color on Button click.
- (50) Create a ComboBox and populate it with country names.
- (51) Create a ListBox and add/remove items dynamically.
- (52) Use PictureBox to display an image.
- (53) Implement MenuStrip with File and Help menus.
- (54) Use ToolStrip with buttons and dropdowns.
- (55) Create a form with Timer to update current time in a Label.
- (56) Create a form with Panel and GroupBox to organize controls.
- (57) Use ColorDialog to select color and change form background.
- (58) Use FontDialog to change font of a TextBox.
- (59) Use OpenFileDialog to select and display image in PictureBox.
- (60) Use SaveFileDialog to save text from TextBox to file.
- (61) Create a multiple-document interface (MDI) parent and child forms.
- (62) Create a form with TreeView to display folder structure.
- (63) Create a form with DataGridView to display tabular data.
- (64) Validate form inputs before submission.
- (65) Generate a Login Form with Username and password (password masking), and a submit button. When user will enter the value and press on submit button, then Message will be display on the screen 'Login Successful!'.
Message will be display on the screen 'Login Successful!'.
- (66) Use tooltip to show help on controls.
- (67) Develop a form that includes a **CheckedListBox** and a **ListBox**. When a user selects an option from the CheckedListBox, the corresponding item should be added to the ListBox. Similarly, when a user deselects an option from the CheckedListBox, the associated item should be removed from the ListBox.

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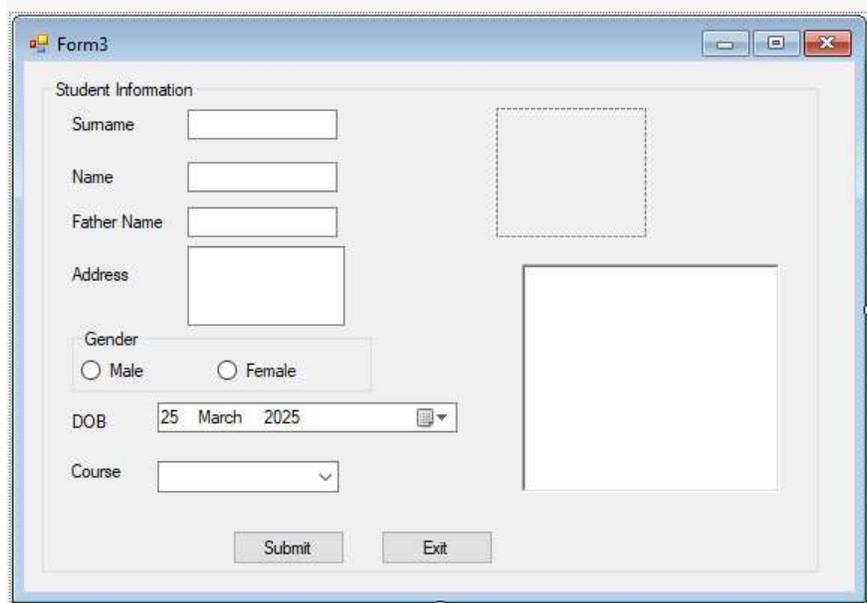


- (68) Generate C# program for checkbox, when user will click on checkbox, the button is enabled, otherwise button is disabled
- (69) Design a C# form with 2 different listboxes and move the items from one listbox to another based on the requirement either single or multiple items at a time.



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- (70) Generate a C# form for student Registration and entered data should be displayed into the RichTextBox.

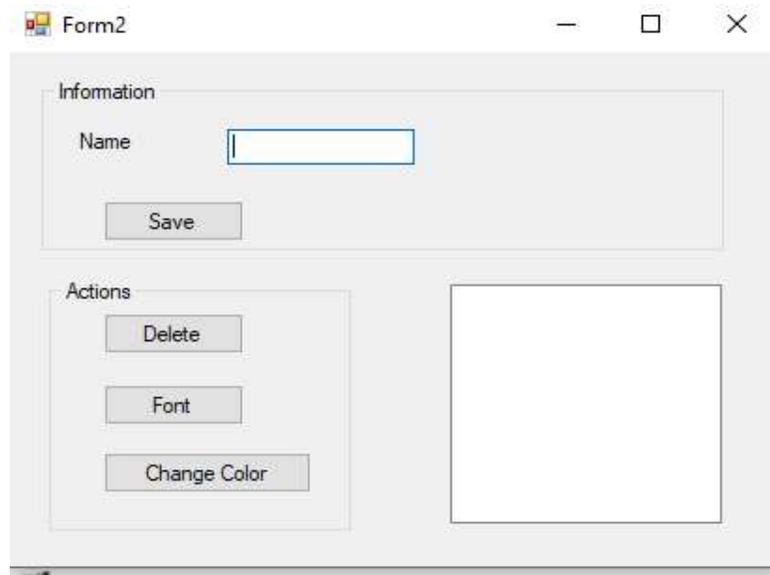


The screenshot shows a Windows application window titled "Form3". The window contains a "Student Information" form with the following fields and controls:

- Surname: Text box
- Name: Text box
- Father Name: Text box
- Address: Text box
- Gender: Radio buttons for Male and Female
- DOB: Date picker showing 25 March 2025
- Course: Dropdown menu
- Two empty RichTextBox areas for displaying data
- Submit and Exit buttons at the bottom

- (71) Design a form with 3 buttons- Start, Calculate and Exit and 2 checkboxes- Sum and Average. When user will click on Start button, program should read numbers one by one. When 0 is entered, reading of numbers will be over. When calculate button is clicked, then, depending upon the choices of checkboxes, sum and/or average should be displayed.
- (72) Generate a C# form to accept Name, City and Age through the textbox and when user will click on the submit button, welcome message will be displayed on the screen.
- (73) Design a C# form with 1 checkedlistbox, 1- textbox and 1 – botton. When user will enter any item in the textbox and click on the button (Add Item), then entered item should be added in the given checkedlistbox.
- (74) Create a C# form to demonstrate scroll bar for RGB function to change a colour of particular label/ form.
- (75) Generate a C# form to insert any name in the textbox and it should be displayed into the listbox, and user can also delete the items/names from the listbox using delete button, change the font style/size/type using the font button and user can also change the color of listbox when click on the change color button.

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- (76) Develop a c# code for select records from the database using DataReader and also display it in the DataGridView .
- (77) Create a form that allows adding new customers, updating their details, and deleting them from the database. Use **Connected Architecture** with SqlCommand and SqlDataReader for reading data.
- (78) Generate a C# form application to perform CRUD operations (Connected/Disconnected) on Employee table.
- (79) Generate a C# form application to navigate the Records.
- (80) Implement disconnected data access by modifying DataSet and updating database.
- (81) Generate a C# form to create master-detail relation using DataRelation.
- (82) Generate a C# form to perform CRUD operation using ListBox.
- (83) Generate a C# form to move data from one form to another form.
- (84) Create a custom UserControl with properties and events.
- (85) Add User control into a Windows Form.
- (86) Create a MDI form with MenuBar and Dialogs.
- (87) Create a Crystal Report based on database table and display it in a form.
- (88) Add a ColorDialog to allow the user to select a color and change the background color of the form.
- (89) Write a code for performing search operation on the Emp table which has fields empno, ename and salary. Display only those employees whose salary is less than 3000.

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BCA-4	
CS-24 Operating system concepts with Unix/Linux	
Minimum following exercise should be performed by the students during the semester	
(1)	Basic Linux Commands Learn and execute simple file & directory commands — pwd, ls, cd, mkdir, rmdir, rm, cp, mv, cat, touch. (Folder create, move, copy, delete, show path, etc.)
(2)	File Permissions Change file access rights and ownership using chmod, chown, chgrp. (Read, Write, Execute permission set karva.)
(3)	Viewing & Filtering Files Display and count file content using head, tail, wc, sort, uniq. (First/last lines, sorting, removing duplicates.)
(4)	Searching & Pattern Matching Search specific text or patterns using grep, egrep, fgrep.
(5)	Cut, Paste & Translate Extract specific columns, merge files and replace characters using cut, paste, tr.
(6)	Use of tee Command Show output on screen and save to a file at the same time using pipes and tee.
(7)	File Compression & Archiving Create and extract compressed archives using tar, gzip, gunzip, zip, unzip.
(8)	Process Management Check and control running processes using ps, top, kill, jobs, bg, fg, nice, renice.
(9)	Text Editing with VI/Nano Create and edit files, insert, delete, search, save and quit using VI or Nano editors.
(10)	Basic Shell Script Write a simple script using variables, echo, and read.
(11)	Decision Making Scripts Use conditions in shell scripts — if, if-else, case statements.
(12)	Looping in Shell Scripts Repeat tasks using for, while, and until loops.
(13)	Command Line Arguments Write shell scripts that accept and use command line arguments (\$1, \$2...).
(14)	Functions in Shell Scripts Create and use user-defined functions for reusable code.
(15)	To perform demonstration of WINE.
(16)	User & Group Management Create, delete, and manage users & groups — useradd, passwd, who, w, id.
(17)	Job Scheduling Schedule and automate tasks using at, batch, cron, crontab.
(18)	Searching Files in System Locate files and commands using find.
(19)	Backup & Restore Create and restore backups using tar and gzip.