

Course Title: Operating System Concepts Course Code: BCA-DSC-4(Maj)-401	
Course Outline	This course introduces students to the basic ideas of Operating Systems. It explains what an operating system does, why it is needed, and how it manages computer hardware, memory, and other resources. The course also introduces the Linux operating system, its structure, and basic commands.
Course Outcome	CO1: Understand the features, types, and functions of an Operating System. CO2: Learn about processes and CPU scheduling methods. CO3: Understand deadlocks and the Banker's algorithm. CO4: Learn memory management techniques. CO5: Use basic Linux commands and simple shell programs.
Student Learning Outcomes	<ul style="list-style-type: none"> • Explain what an operating system is and what services it provides. • Understand how processes work and how the CPU schedules them. • Identify deadlocks and understand how to handle them. • Understand memory concepts like paging, segmentation, fragmentation, and virtual memory. • Use Linux commands, work with files and directories, and write simple shell scripts.
Course content/Syllabus	As prescribed by Panjab University UNIT - I Operating Systems (OS): Introduction, its needs and services, Types of OS: Multi-user, Multitasking, Multiprocessing and Real time Operating Systems, Parallel systems, Distributed systems. Process Management: Introduction to Process, PCB, Process States, CPU Scheduling: Scheduling Criteria and Algorithms: FCFS, SJF, Priority, Round Robin, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling. UNIT - II Deadlocks: Necessary and sufficient conditions for Deadlocks, Introduction to methods for handling deadlocks, deadlock detection and recovery. 29 Memory Management: Logical vs Physical address space, Swapping, Fragmentation: External and Internal, Compaction, Introduction to Paging, Segmentation, and Virtual Memory-Demand paging, Introduction to Page Replacement algorithms: FIFO, Optimal Page replacement and LRU. UNIT - III Introduction to Linux: Linux's shell, Kernel, Features of Linux, History, Minimum system requirements, Boot and Root disks, Starting and stopping Linux system, logging in and out. General-Purpose Utilities: cal, date, echo, printf, bc-The calculator, script, passwd, pager (more and less), Terminal Handling commands: who, uname, tty. Using file system: Introduction to common types of files, Filenames, Introduction to different types of directories:: Parent, Subdirectory, Home directory; rules to name a directory, Important directories in Linux File System, Absolute and relative filenames. File and Directory handling commands: creating files and directories (cat, mkdir), change directory (cd), listing files (ls), pwd, moving and copying files (mv, cp), moving directories, removing files and directories (rm, rmdir), File handling commands: word count (wc), comparing two files (cmp), common between file (comm), converting one file to other (diff), using wildcards with files and directories. File and directory permissions, change/set file

	<p>permissions using relative and absolute methods, Changing group ownership, umask settings, Understanding wildcards, Environment variables. Understanding I/O Redirection and Piping, tee; Simple filters: pr, head, tail, cut, paste, sort, uniq; Introduction to Regular Expressions and grep.</p> <p style="text-align: center;">UNIT - IV</p> <p>Process Management: Types of processes, ps, bg, fg, nice, kill. vi editor: starting vi, vi modes, inserting text, quitting vi, deleting text, copying and moving text, searching and replacing text. Basic Shell Programming: Shell script, read, if statement, numeric and string comparison operators, case statement, expr command, loops (while and for). System Administration activities: Superuser (su) command, Taking backups using tar, Managing disk space, Mounting and Un-mounting file system, Managing users, Managing printers with lpd, mknod, lpc, lpq, lprm.</p>
Required Text	<ol style="list-style-type: none"> 1. Peterson, J.L. & Silberschatz, A.: <i>Operating System Concept</i>, Addison Wesley 2. John Goerzen: <i>Linux Programming Bible</i>, IDG Books, New Delhi, 2000 3. A.S. Tenenbaum: <i>Operating System: Design and Implementation</i>, PHI, 1989 4. Petersen Richard: <i>Linux: The Complete Reference</i>, McGraw Hill, 2017
Suggested Text, readings and Materials	<ul style="list-style-type: none"> • Brinch Hansen: <i>Operating System Principles</i>, Prentice Hall of India • Haberman, A.N.: <i>Introducing to Operating System Design</i>, Galgotia Publications, New Delhi • Sumitabha Das: <i>Your Unix – The Ultimate Guide</i>, TMH, 2000
Pedagogy for Course Delivery	Lectures, Practical implementations, discussions, Assignments
Evaluation Criteria	<p>10 marks will be internal assessment based on Mid-Semester Test, Academic Activity (Seminar, Project, Assignments) and Attendance.</p> <p>90 marks will be external assessment based on examinations conducted by Panjab University.</p>

Course Title: Database Management System Course code: BCA-DSC-4(Maj)-402	
Course Outline	This course gives students an understanding of the basic concepts of database management systems and how to use them with database software.
Course Outcome	CO1: Understand fundamental database concepts CO2: Learn the basics of relational database management systems CO3: Write SQL queries and understand SQL operations CO4: Learn the basics of PL/SQL programming
Student Learning Outcomes	On completion of this course, the students will be able to: <ul style="list-style-type: none"> • Understand the basic concepts of databases and how DBMS works. • Learn the relational model and apply normalization techniques. • Write SQL queries to create, update, delete, and retrieve data. • Use PL/SQL to write simple programs, handle exceptions, and work with triggers.
Course content/Syllabus	<p style="text-align: center;">As prescribed by Panjab University</p> <p style="text-align: center;">UNIT - I</p> <p>Basic Concepts: A Historical perspective, File Systems vs. DBMS, Characteristics of the Data Base Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of DBMS, Data Base Systems Concepts and Architecture: Schemas and Instances, DBMS architecture and Data Independence, Data base languages & Interfaces, DBMS functions and component modules, Entity Relationship Model: Entity Types, Entity Sets, Attributes & Keys, Relationships, Relationship Types, Roles and Structural Constraints, Design issues, weak entity types, E- R Diagrams. Design of an E-R Database Schema.</p> <p style="text-align: center;">UNIT - II</p> <p>Relational Data Model: Relational model concepts, Integrity constraints over Relations, Relational Algebra - Basic Operations. Conventional Data Model: An overview of Network and Hierarchical Data Models. Relational Data Base Design : Functional Dependencies, Decomposition, Desirable properties of decomposition, Normal forms based on primary keys (1 NF, 2 NF, 3 NF and BC NF).</p> <p>RDBMS: Terminology, The 12 Rules (Codd's Rule) for an RDBMS.</p> <p style="text-align: center;">UNIT - III</p> <p>Understanding SQL-1: Data Types, Creating Tables, Creating a Table with data from Another table, Inserting Values into a Table, Updating Column(s) of a Table, Deleting Row(s) from a Table, Dropping a Column, Querying database tables, Conditional retrieval of rows, Working with Null Values, Matching a pattern from a table, ordering the result of Query Aggregate Functions, Grouping the Result of a Query, creation and deletion of Views, Managing privileges with Grant and Revoke Command, COMMIT and ROLLBACK, Functions: Character Functions, Date Functions, Group Functions</p> <p style="text-align: center;">UNIT - IV</p>

	<p>Understanding SQL-II: Querying Multiple Tables using Equi-Joins, Cartesian Joins, Outer Joins, Self-Joins, SET Operators: Union, Intersect, Minus; Introduction to Nested Queries</p> <p>PL/SQL: Introduction to PL/SQL, The Advantage of PL/SQL, PL/SQL Block Structure, PL/SQL Architecture, Fundamentals of PL/SQL, PL/SQL Data Types, Variables and Constants, Scope and Visibility of a Variable, Assignments and Expressions, Operator Precedence, Conditional and Iterative Control, Cursor Management in PL/SQL, Implicit/explicit Cursor Attributes, Exception Handling in PL/SQL; Predefined Exceptions, User Defined Exceptions, Database Trigger, types of triggers, dropping triggers</p>
Required Text	<ol style="list-style-type: none"> 1. Elmasri & Navathe: <i>Fundamentals of Database Systems</i>, 2017, 7th Edition, Addison Wesley 2. Ivan Bayross: <i>SQL, PL/SQL</i>, 2020, Fourth Edition, BPB Publication 3. C.J. Date: <i>An Introduction to Database Systems</i>, 8th Edition, 2003, Addison Wesley 4. Korth & Silberschatz: <i>Database System Concepts</i>, 2010, 6th Edition, McGraw Hill
Suggested readings and Materials	<ul style="list-style-type: none"> • Bipin C. Desai: <i>An Introduction to Database Systems</i>, 2015, Galgotia Publications • Raghu Ramakrishnan & Johannes Gehrke: <i>Database Management Systems</i>, 2002, 3rd Edition, McGraw Hill
Pedagogy for Course Delivery	Lectures, Practical work, Discussions, Assignments and Quiz
Evaluation Criteria	5 marks will be internal assessment based on Mid-Semester Test, Academic Activity (Seminar, Project, Assignments) and Attendance. 45 marks will be external assessment through examinations conducted by Panjab University.

Course Title: Practical Based on paper BCA-DSC-4(Maj)-402 Paper Code: BCA-DSC-4(Maj)-402P	
Course Outline	This practical course allows students to apply SQL and PL/SQL concepts. Students will perform hands-on exercises related to data definition, data manipulation, queries, functions, joins, and PL/SQL programming
Course Outcome	On completion of this course, the students will be able to: CO1: Use SQL commands to create, update, and manage database tables. CO2: Retrieve and process data using functions, joins, and set operators. CO3: Write PL/SQL programs for calculations, conditions, loops, and patterns.
Student Learning Outcomes	<ol style="list-style-type: none"> 1. Apply SQL commands (DDL, DML, DCL, TCL) to create, modify, and manage database tables. 2. Retrieve and process data using queries, functions, joins, views, and set operators. 3. Write basic PL/SQL programs using variables, conditions, loops, cursors, and exceptions. 4. Develop PL/SQL scripts that perform calculations, handle errors, and work with triggers.
Course content/Syllabus	<p style="text-align: center;">As prescribed by Panjab University</p> <ol style="list-style-type: none"> 1. Write PL/SQL blocks to declare variables. 2. Write a PL/SQL program to check whether a number is even or odd. 3. Write a PL/SQL program to find the greatest of three numbers. 4. Write a PL/SQL program to display the grade of a student using else-if ladder. 5. Write a PL/SQL program to display description against a grade using CASE statement. 6. Write a PL/SQL program to print the first n numbers. 7. Write a PL/SQL program to find the factorial of a number. 8. Write a PL/SQL program to print the multiplication table of a number. 9. Write a PL/SQL program to find the average of first n numbers. 10. Write a PL/SQL program to reverse a given number. 11. Write a PL/SQL program using nested loops to print a pattern. 12. Write a PL/SQL program to show the use of %TYPE and %ROWTYPE. 13. Write a PL/SQL program to demonstrate implicit and explicit cursors. 14. Write a PL/SQL program to use implicit and explicit exceptions. 15. Write a PL/SQL program to demonstrate trigger execution.
Required Text	<ol style="list-style-type: none"> 1. Elmasri & Navathe: <i>Fundamentals of Database Systems</i>, 2017, 7th Edition, Addison Wesley 2. Ivan Bayross: <i>SQL, PL/SQL</i>, 2020, Fourth Edition, BPB Publication

	<p>3. C.J. Date: <i>An Introduction to Database Systems</i>, 8th Edition, 2003, Addison Wesley</p> <p>4. Korth & Silberschatz: <i>Database System Concepts</i>, 2010, 6th Edition, McGraw Hill</p>
Suggested Text, readings and Materials	<ul style="list-style-type: none"> • Bipin C. Desai: <i>An Introduction to Database Systems</i>, 2015, Galgotia Publications • Raghu Ramakrishnan & Johannes Gehrke: <i>Database Management Systems</i>, 2002, 3rd Edition, McGraw Hill
Pedagogy for Course Delivery	Using real-world examples and hands-on activities to make statistics relevant and engaging. Encourage active participation and critical thinking to deepen understanding.
Evaluation Criteria	The practical examination carries a total of 50 marks , which will be awarded based on the student's performance during the university-conducted practical exam. The assessment will include program execution, viva-voce, and evaluation of the practical record. The entire evaluation is done externally as per the rules of Panjab University.

Course Title: Information System Design and Implementation	
Paper code: BCA-DSC-4(Maj)-403	
Course Outline	This course teaches students the main ideas of information systems, their analysis, and their design. It helps learners understand the steps needed in software development and the different methods used. After completing the course, students will be able to analyze and design information systems.
Course Outcome	<p>CO1: Understand System Development Life Cycle and the role of a System Analyst.</p> <p>CO2: Learn SRS, flow diagrams, and other analysis tools.</p> <p>CO3: Understand feasibility study, testing, and quality assurance.</p> <p>CO4: Learn system implementation, installation, and maintenance.</p>
Student Learning Outcomes	<ol style="list-style-type: none"> 1. Describe what systems are and how information systems work. 2. Understand and explain the different phases of the System Development Life Cycle. 3. Use tools like DFD, Data Dictionary, Decision Tables, and ER diagrams for system analysis. 4. Evaluate feasibility, design systems, and understand testing and quality assurance. 5. Explain system implementation, maintenance, and hardware/software selection procedures.
Course content/Syllabus	<p>As prescribed by Panjab University</p> <p>UNIT - I</p> <p>Systems Concepts and Information Systems Environment: Definition and characteristics of a system. Elements of a system Environment: Boundaries and interface. Types of systems: Physical or Abstract Systems, Open and Closed System, Man - made information systems. Types of System Models. System Development Life Cycle: Introduction to various phases-Recognition of Need, Feasibility Study, Analysis, Design, Implementation, Post- Implementation and Maintenance. The Role of System Analyst: Skills of a System Analyst, Duties of the System Analyst.</p> <p>UNIT - II</p> <p>System Planning and the Initial Investigation: Bases for planning in system analysis, Initial investigation, determining the user's information requirements, Problem definition and Project Initiation, Background Analysis, Fact Finding, Fact Analysis, Determination of Feasibility. Information Gathering: Introduction, Information Gathering tools: Review of Literature, Procedures and forms. On -site observation. Interviews and questionnaires. Tools of Structured Analysis: SRS features and structure, Various tools of structured analysis: Data flow diagram (DFD), Data Dictionary, Decision tree and structured English, Decision table, Pros and cons of each tools, ER-Diagrams</p>

	<p style="text-align: center;">UNIT - III</p> <p>Feasibility Study: System Performance-statement of Constraints, Identification of Specific System Objectives, description of Outputs. Feasibility Study – Feasibility considerations, Steps in feasibility analysis. Feasibility Report. System Design: The Process of Design-Logical and Physical Design, Design methodologies: Structured design, Functional Decomposition System Testing: Testing, System testing, test phases, types of System Testing, WBT and BBT techniques, OO testing. Quality Assurance: Quality assurance and its goals in its system life cycle, Levels of quality assurance, Trends in testing.</p> <p style="text-align: center;">UNIT - IV</p> <p>Implementation and Software Maintenance: Introduction, Conversion-Activity network for Conversion, File Conversion, User Training: Elements of user Training Post implementation review. Software Maintenance - Primary activities of a Maintenance Procedure, Reducing Maintenance Costs. Types of Software Maintenance. Hardware and Software Selection: Types of Software, Procedure for Hardware/Software selection: Major phases in selection, Evaluation and Validation, Vendor Selection, Post – Installation Review. Software selection- Criteria for Software Selection, the evaluation process</p>
Required Text	<ol style="list-style-type: none"> 1. WS Jawadekar & SS Dubey, <i>Management Information System</i>, McGraw Hill, 2020 2. Alan Dennis, Barbara Haley Wixom, Roberta M. Roth, <i>Systems Analysis and Design</i>, 2018, Wiley
Suggested Text, readings and Materials	<ul style="list-style-type: none"> • Hardgrave Bill C., Siau Keng, Chiang Roger H.L., <i>Systems Analysis and Design: Techniques, Methodologies, Approaches and Architectures</i>, 2017 • E.M. Awad, <i>Systems Analysis and Design</i>, 2015, Galgotia Publications
Pedagogy for Course Delivery	The course will be delivered through classroom lectures, practical demonstrations, discussions, and assignments.
Evaluation Criteria	The course-level assessment includes continuous internal assessment of 10 marks, which will be awarded based on mid-semester tests, classroom participation, and assignments. The external assessment will carry 90 marks and will be based on the student’s performance in the examination conducted by Panjab University.

Course Title: Cyber Security Paper Code: BCA-DSC-4(Maj)-404	
Course Outline	This course introduces the basic concepts of cybersecurity, cyberspace, cybercrimes, data privacy, and security measures. It aims to help students understand different types of cyber threats, attacks, legal aspects, and methods to protect systems and data.
Course Outcome	<p>CO1: Understand cyber security architecture, cyberspace regulations, and basic terms used in cyber security.</p> <p>CO2: Identify and analyze web-based attacks, network vulnerabilities, and exploit tools.</p> <p>CO3: Recognize different types of cybercrimes and understand legal frameworks and reporting mechanisms.</p> <p>CO4: Understand data privacy principles and compliance with national and international regulations.</p>
Student Learning Outcomes	<p>On the successful completion of this course, the students should be able to</p> <ol style="list-style-type: none"> 1. Explain cyberspace, cyber security concepts, and key security terminologies. 2. Identify common cyber-attacks, vulnerabilities, and exploitation tools used by attackers. 3. Understand different types of cybercrimes and apply basic legal knowledge to address them. 4. Describe data privacy principles, protection techniques, and global data protection laws. 5. Understand security threats such as malware, phishing, password cracking, SQL injection, buffer overflow, and DoS/DDoS attacks.
Course content/Syllabus	<p>As prescribed by Panjab University.</p> <p>UNIT - I</p> <p>Introduction to Cyber security:</p> <p>Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security. Defining Cyber Security, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker, Controls, Authentication, Access Control and Cryptography</p> <p>UNIT - II</p> <p>Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.</p> <p>Network Vulnerabilities: Overview of vulnerability scanning, Open, Port / Service Identification, Banner/Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, Open VAS, Meta sploit. Networks Vulnerability Scanning (Ncat, Socat), Network Sniffers and Injection tools.</p>

	<p style="text-align: center;">UNIT - III</p> <p>Cyber-crime and Cyber law: Classification of cyber-crimes, Common cyber-crimes- cybercrime targeting computers and mobiles, cyber-crime against women and children, financial 36 frauds, social engineering attacks, malware and ransom-ware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India</p> <p style="text-align: center;">UNIT - IV</p> <p>Data Privacy and Data Security: Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR), 2016 Personal Information Protection and Electronic Documents Act (PIPEDA), Social media- data privacy and security issues. Firewalls and Packet Filters, password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.</p>
Required Text	<ol style="list-style-type: none"> 1. Cyber Security and Cyber War: What Everyone Needs to Know – P.W. Singer & Allan Friedman (2014) 2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives – Sumit Belapure & Nina Godbole, Wiley India (2011) 3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities – Henry A. Oliver (2015)
Suggested Text, readings and Materials	<ul style="list-style-type: none"> • Security and Privacy in Communication Networks – Nosseir, Ekici & Cavallaro (2021) • Information Security Governance – W. Krag Brothy, Wiley (2009) • Auditing IT Infrastructures for Compliance – Martin Weiss & Michael G. Solomon (2nd Edition, 2015)
Pedagogy for Course delivery	Lectures, discussions, Assignment
Evaluation Criteria	The course-level assessment includes continuous internal assessment of 10 marks . These 10 marks will be awarded based on mid-semester tests, classroom participation, and assignments. The external assessment carries 90 marks , which will be based on the student’s performance in the examination conducted by Panjab University.

Course Title: Python Programming Paper Code: BCA-DSC-4(Min)-405	
Course Outline	This course introduces the basic concepts of Python programming. Students will learn Python syntax, data types, control structures, lists, tuples, dictionaries, functions, classes, exception handling, and file handling. The module enables students to write and execute Python programs using standard libraries.
Course Outcome	CO1: Understand fundamental Python concepts, syntax, and semantics. CO2: Use lists, tuples, dictionaries, and functions in Python programs. CO3: Create and work with files in Python. CO4: Use Python modules, built-in functions, and classes.
Student Learning Outcomes	On the successful completion of this course, the students should be able to <ol style="list-style-type: none"> 1. Write basic Python programs using variables, operators, loops, and conditional statements. 2. Work with Python data types such as lists, tuples, strings, and dictionaries. 3. Create and use functions and classes for modular programming. 4. Handle errors using exception-handling techniques. 5. Perform file operations such as opening, reading, writing, and navigating through files.
Course content/Syllabus	As prescribed by Panjab University. UNIT - I Introduction to Python Programming, Data Types, Operators, Expressions, Variables, Scope of a variable, Type Conversion in Python, if statement: simple if, if-else, if-elif-else chain, if statement with lists; Loops: Selection, Indentation, Repetition, Break and Continue statement, Nested Loops, while loop with lists and dictionaries, Strings: Introduction to String, String Operations, Transversal of string, Methods and Inbuilt Functions. UNIT - II Lists: Definition, Operations, Traversal, Methods and Inbuilt Functions, Nested Lists, Copying Lists, List as an argument, Mutable and Immutable Data types. Tuples: Introduction, Operations, Traversal, Methods and Inbuilt Functions, Nested Tuples. Dictionaries: Introduction, Traversal, Methods and Inbuilt Functions, Manipulating Dictionary. UNIT - III Function: definition, advantages, User defined functions: defining a function, passing arguments, return values, passing a list, Python standard Libraries. Classes: creating and using a class, working with classes and instances, importing classes, Python standard library. UNIT - IV Exception Handling: exceptions and errors, try-except block, the else block, handling the ZeroDivisionError and FileNotFoundError exception.

	File Handling: Introduction, Types of Files, Opening and Closing File, Writing to a file, Reading from a file, Setting offset in a file, Creating and Traversing a file.
Required Text	<ol style="list-style-type: none"> 1. <i>Learning Python</i> – Mark Lutz, 5th Edition, O’Reilly Media, 2015 2. <i>Python Programming: A Complete Guide for Beginners</i> – Brian Draper, 2016 3. <i>Python Programming for Beginners</i> – Adam Stark, 2016
Suggested Text, readings and Materials	<ul style="list-style-type: none"> • Python Essential Reference – David M. Beazley, 4th Edition, Pearson, 2009 • Python Programming: An Introduction to Computer Science – John M. Zelle, 2nd Edition, 2003 • Python Crash Course – Eric Matthes, 2nd Edition, 2019
Pedagogy for Course delivery	The course will be taught through classroom lectures, hands-on programming demonstrations, practical exercises, and assignments. Students will learn Python concepts step by step and apply them by writing small programs. This approach will help students clearly understand Python syntax, data structures, functions, and file handling.
Evaluation Criteria	The course-level assessment includes continuous internal assessment of 5 marks , awarded through mid-semester tests, classroom participation, and assignments. The external assessment carries 45 marks , which will be based on the student’s performance in the examination conducted by Panjab University.

Course Title: Practical based on paper BCA-DSC-4(Min)-405 (Python Practical)	
Paper Code: BCA-DSC-4(Min)-405P	
Course Outline	This practical course allows students to apply the basic concepts of Python programming. Through hands-on exercises, students will practice writing programs using numbers, strings, lists, tuples, dictionaries, functions, recursion, classes, exceptions, and file handling.
Course Outcome	<p>On completion of this course, the students will be able to:</p> <p>CO1: Apply basic Python programming concepts to solve simple problems.</p> <p>CO2: Use lists, tuples, dictionaries, and strings to perform different operations in Python.</p> <p>CO3: Write Python programs using functions, recursion, classes, objects, and exception handling.</p> <p>CO4: Perform file handling operations such as reading, writing, and processing data stored in files.</p>
Student Learning Outcomes	<ol style="list-style-type: none"> 1. Write simple Python programs using loops, conditions, strings, and lists. 2. Work with tuples and dictionaries by performing operations like adding, removing, and sorting elements. 3. Apply recursion, classes, objects, and exception handling in programs. 4. Perform file input/output operations such as reading and writing files.
Course content/Syllabus	<p style="text-align: center;">As prescribed by Panjab University</p> <ol style="list-style-type: none"> 1. Program to find the largest out of two numbers. 2. Program to find out whether a given number is even or odd. 3. Program to print the first ten natural numbers. 4. Program to find the factorial of a number. 5. Program to find out whether a given number is prime or not. 6. Program to find whether a given string is palindrome or not. 7. Program to implement string functions: len(), count(), join(),split() 8. Program to print all the elements of the list. 9. Program to reverse the elements of the list. 10. Program to find whether an element exists in the list or not. 11. Program to clear a list. 12. Program to copy a list 13. Program to find the largest and smallest element from a list. 14. Program to find the length of a tuple 15. Program to remove tuples from list 16. Program to sort tuples. 17. Program to create a dictionary, access dictionary items, add items to a dictionary, remove items from a dictionary, change items from a dictionary, find dictionary length. 18. Program to swap two numbers 19. Program to implement recursion 20. Simple Programs to implement classes and objects in python. 21. Program to handle exception ZeroDivsisonError and FileNotFoundError 22. Program to read and write to file.

Required Text	<ol style="list-style-type: none"> 1. <i>Learning Python</i> – Mark Lutz, 5th Edition, O’Reilly Media, 2015 2. <i>Python Programming: A Complete Guide for Beginners</i> – Brian Draper, 2016 3. <i>Python Programming for Beginners</i> – Adam Stark, 2016
Suggested Text, readings and Materials	<ul style="list-style-type: none"> • Python Essential Reference – David M. Beazley, 4th Edition, Pearson, 2009 • Python Programming: An Introduction to Computer Science – John M. Zelle, 2nd Edition, 2003 • Python Crash Course – Eric Matthes, 2nd Edition, 2019
Pedagogy for Course Delivery	<p>The practical sessions will be conducted through demonstrations, supervised lab work, and guided programming exercises. Students will learn by writing and running Python programs, experimenting with different data types, and solving small coding problems. This hands-on approach will help them gain confidence in Python programming.</p>
Evaluation Criteria	<p>The practical examination carries a total of 50 marks, which will be awarded based on the student’s performance during the university-conducted practical exam. The assessment will include program execution, viva-voce, and evaluation of the practical record. The entire evaluation is done externally as per the rules of Panjab University.</p>

Course Title: LANGUAGE SKILLS: LISTENING, SPEAKING, READING, WRITING II	
Paper Code: ENG-AEC-4-401	
Course Outline	This course helps students improve their overall English communication skills. It focuses on listening, speaking, reading, and writing abilities needed for academic, personal, and professional use. Students will learn how language works, how it changes, and how to express ideas clearly and confidently.
Course Outcome	<p>CO1: Understand how language functions and varies across different social and cultural contexts.</p> <p>CO2: Communicate ideas clearly and confidently in English through speaking and writing.</p> <p>CO3: Participate effectively in discussions, debates, and public speaking activities.</p> <p>CO4: Use English language skills to achieve personal and professional communication goals.</p>
Student Learning Outcomes	<p>On the successful completion of this course, the students should be able to</p> <ol style="list-style-type: none"> 1. Improve listening skills and understand spoken English in different situations. 2. Speak clearly and confidently in conversations, discussions, and presentations. 3. Read and understand academic texts, identify key ideas, and interpret information. 4. Write sentences and paragraphs using correct grammar, vocabulary, and structure. 5. Use English effectively in academic tasks and real-life communication.
Course content/Syllabus	<p>As prescribed by Panjab University.</p> <p>UNIT - I</p> <p>Networks (Listening, Speaking, Reading, Writing, Vocabulary) Pg. 91-104</p> <p>UNIT - II</p> <p>Crime (Listening, Speaking, Reading, Writing, Vocabulary) Pg. 133-146</p> <p>UNIT - III</p> <p>Progress (Listening, Speaking, Reading, Writing, Vocabulary) Pg. 161-174</p>
Required Text	<p>Edward de Chazal & Louis Rogers, <i>Oxford EAP: A Course in English for Academic Purposes (Intermediate/B1+)</i>, Oxford University Press, 2013 (Reprinted 2022). – Main textbook used in the course for listening, speaking, reading, writing, and vocabulary development.</p>
Pedagogy for Course delivery	The course includes 4 hours of practical sessions each week. During these sessions, students will learn communication concepts through hands-on activities such as listening exercises, speaking tasks, reading practice, and writing assignments. Real-life communication scenarios, group discussions, and guided practice will be used to help students develop confidence and fluency in English.
Evaluation Criteria	The course is assessed out of 50 marks , including 30 marks for theory, 15 marks for practicals, and 5 marks for internal assessment. The practical exam for 15 marks will be conducted by an external examiner, either from the same department or from another institution. Internal assessment marks will be based on class participation, assignments, and continuous performance throughout the semester.

Course Title: Introduction to Blockchain Technology Course Code: CSA-VAC101/201/301/401	
Course Outline	This course introduces students to the basic ideas of blockchain technology, how it works, and its applications. It covers blockchain principles, cryptography fundamentals, blockchain types, and real-life uses of blockchain in different areas.
Course Outcome	CO1: Understand what blockchain is and how it works. CO2: Describe the core components involved in blockchain technology. CO3: Understand basic cryptography used in blockchain systems. CO4: Explain different types of blockchains and their real-world applications.
Student Learning Outcomes	<ul style="list-style-type: none"> • Explain the meaning, purpose, and need of blockchain technology. • Identify different blockchain components such as blocks, nodes, hashing, and consensus mechanisms. • Understand cryptographic concepts like encryption and ciphers used within blockchain. • Analyse use cases of blockchain in finance, supply chain, governance, social systems, and other domains.
Course content/Syllabus	As prescribed by Panjab University UNIT - I History of Blockchain, Terminologies in Blockchain, Types of Blockchain, Applications of Blockchain, How blockchain works, Ingredients of Blockchain. Various types of Blockchain and its real time applications. Introduction to cryptography-Encryption and Decryption, Ciphers UNIT – II Introduction to Consensus Methods - Proof of Work(PoW), Proof of Stake(PoS), Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems. Block chain Cryptography: Privacy and Security on Block chain.
Required Text	<ol style="list-style-type: none"> 1. Mark Gates, <i>Block Chain: Ultimate Guide to Understanding Block Chain, Bitcoin, Cryptocurrencies, Smart Contracts and the Future of Money</i>, Wise Fox Publishing, 2017. 2. Babujy, Vijay Madiseti, <i>Blockchain Applications: A Hands-On Approach</i>, Arshdeep Bahga, Vijay Madiseti Publishers, 2017.
Pedagogy for Course Delivery	The course will be taught through classroom lectures, demonstrations, and real examples of blockchain applications. Practical examples from cryptocurrency, governance, and social systems will be used to make learning easier.
Evaluation Criteria	The course includes 5 internal marks , awarded through assignments, class participation, and mid-semester work. The external examination carries 45 marks and will be based on the student's understanding of blockchain concepts, principles, and applications, as evaluated in the final university examination.

Course Title: Introduction to Computer Hardware Course Code: CSA-VAC102/202/302/402	
Course Outline	This course introduces students to the basic components of computer hardware. It explains different input/output devices, motherboard parts, ports, BIOS, installation of operating systems, formatting, and the basics of computer maintenance and protection.
Course Outcome	CO1: Identify and describe the main hardware components of a computer. CO3: Install Windows and perform disk partitioning and formatting. CO4: Understand basic maintenance tasks, including antivirus installation and firewall features.
Student Learning Outcomes	<ul style="list-style-type: none"> • Recognize key hardware devices such as input/output components, storage devices, and add-on cards. • Explain the function of motherboard parts, ports, memory types, and power supplies. • Connect and disconnect peripherals safely and troubleshoot basic hardware issues. • Understand firewall use, antivirus installation, and basic system protection.
Course content/Syllabus	As prescribed by Panjab University UNIT - I Introduction to computer hardware: Definition, Peripheral devices of a Computer system, Add On cards: network interface card, sound card and graphics card, functional description of various parts of a PC, UPS, Types of UPS: offline, online and line interactive UPS Various Components of a PC: MotherBoard: Types of Motherboard AT, ATX, and BTX. Ports: Types of Ports, serial and parallel ports. Hard Disk: Types of Hard Disk: PATA, SATA, SCSI. RAM: Types of RAM: SRAM, DRAM, SDRAM, Power supply unit, cabinet, Processor. UNIT - II BIOS: Introduction, Connecting & disconnecting computer peripherals and components, Mouse, Keyboard, Monitor, Hard Disk. Window installation, Hard disk: partitioning and formatting, creating, formatting and deleting partitions using DISKPART in Command Prompt and Graphical User Interface. Antivirus: features and Significance, Installing third party application. Firewall: Introduction to firewall, Features of firewall.
Required Text	<ol style="list-style-type: none"> 1. Govindarajalu, B., IBM-PC and Clones – Hardware Troubleshooting and Maintenance, Tata McGraw Hill. 2. Basandra, S. K., Computers Today, Galgotia Publications. 3. Craig Zacker, The Complete Reference: PC Hardware, TMH Publication.
Pedagogy for Course Delivery	Lectures, Practical implementations, discussions, Assignments
Evaluation Criteria	The course includes 5 internal marks , awarded through assignments, class participation, and mid-semester work. The external examination carries 45 marks and will be based on the student's understanding of blockchain concepts, principles, and applications, as evaluated in the final university examination.

Course Title: Digital Empowerment Course Code: CSA-VAC103/203/303/403	
Course Outline	This course helps students understand the digital world and the importance of digital empowerment. It introduces Digital India initiatives, communication tools, collaborative digital platforms, cyber safety, privacy, and ethical use of digital technologies.
Course Outcome	CO1: Understand the digital ecosystem and the need for digital empowerment. CO2: Gain awareness about Digital India initiatives and digital services. CO3: Communicate and collaborate effectively using online tools and digital platforms. CO4: Understand cyber safety, privacy, and ethical issues in the digital world.
Student Learning Outcomes	<ol style="list-style-type: none"> 1. Use ICT tools and digital services in daily life. 2. Communicate and collaborate using social platforms and online learning tools. 3. Identify security and privacy issues in the digital environment. 4. Understand and evaluate ethical issues in cyberspace.
Course content/Syllabus	As prescribed by Panjab University UNIT - I Digital Inclusion and Empowerment: Needs and Challenges, Vision of Digital India: DigiLocker, E-Hospitals, e-Pathshala, BHIM, e-Kranti (Electronic Delivery of Services), and e-Health Campaigns. Communication and Collaboration in the Cyberspace: Electronic mail, blogs, social media, Collaborative Digital platforms, Tools/platforms for online learning, Collaboration using file sharing, messaging, video conferencing. UNIT - II Towards Safe and Secure Cyberspace: Online Security and Privacy, Threats in the Digital World: Data Breach and Cyber Attacks, Blockchain Technology, Security Initiatives by the Govt of India. Ethical Issues in the Digital World: Netiquettes, Ethics in Digital Communication, Ethics in Cyberspace
Required Text	<ol style="list-style-type: none"> 1. David Sutton, <i>Cyber Security: A Practitioner's Guide</i>, BCS Learning & Development Limited, 2017. 2. Mahendra Pal Singh, <i>V.N. Shukla's Constitution of India</i>, Eastern Book Company, 13th Revised Edition, 2017. 3. Rodney Jones & Christoph Hafner, <i>Understanding Digital Literacies: A Practical Introduction</i>, Routledge, 2nd Edition, 2021.
Pedagogy for Course Delivery	The course will be delivered through lectures, demonstrations, and hands-on activities. Students will explore digital tools, online platforms, communication methods, and collaboration techniques
Evaluation Criteria	The course includes 5 internal marks , awarded through assignments, class participation, and mid-semester work. The external examination carries 45 marks and will be based on the student's understanding of blockchain concepts, principles, and applications, as evaluated in the final university examination.

Course Title: Ethics of Artificial Intelligence Course Code: CSA-VAC104/204/304/404	
Course Outline	This course introduces students to the ethical issues connected with Artificial Intelligence. It explains how AI affects human life, why ethical principles are important, and how AI can be governed using frameworks, values, and guidelines. Students will also study real-world applications of AI ethics in fields like healthcare, transportation, policy, and smart cities.
Course Outcome	CO1: Understand the meaning and importance of ethics in Artificial Intelligence. CO2: Identify ethical issues that arise in the development and use of AI technologies. CO3: Analyze the impact of AI on accountability, transparency, and responsibility in computer systems. CO4: Explain how AI ethics applies to real-world domains like healthcare, transportation, military, and education.
Student Learning Outcomes	<ol style="list-style-type: none"> 1. Define AI ethics and explain why it is essential in modern technology. 2. Recognize ethical problems such as bias, fairness, transparency, and responsibility in AI. 3. Evaluate different frameworks and models that guide ethical AI development. 4. Discuss ethical implications of AI in real-life sectors such as medical care, public policy, education, and smart cities. 5. Reflect on human–AI relationships and the moral status of artificial agents.
Course content/Syllabus	As prescribed by Panjab University UNIT - I Introduction: Artificial Intelligence, Understanding Ethics, Introduction to AI Ethics, Role of AI in Human Life, Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our Relationship with Artificial Entities. Framework and Models: AI Governance by Human-Right Centered Design, Normative Models, Role of Professional Norms, Teaching Machines to be Moral. UNIT - II Concepts and Issues: Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a Moral Right-holder. Perspectives and Approaches: Perspectives on Ethics of AI, Integrating Ethical Values and Economic Value, Automating Origination, Machine Learning Values, Artificial Moral Agent. Application Ethics of AI: Application Ethics of AI in Transport, Ethical AI in Military, Biomedical Research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, and Smart City Ethics.
Required Text	<ol style="list-style-type: none"> 1. S. Matthew Liao, Ethics of Artificial Intelligence, Oxford University Press, 2020. 2. Wallach, W. & Allen, C., Moral Machines: Teaching Robots Right from Wrong, Oxford University Press, 2008. 3. Markus D. Dubber, Frank Pasquale, Sunit Das, The Oxford Handbook of Ethics of AI, Oxford University Press, 2020. 4. Paula Boddington, Towards a Code of Ethics for Artificial Intelligence, Springer, 2017.

Pedagogy for Course Delivery	Lectures, Practical implementations, discussions, Assignments
Evaluation Criteria	The course includes 5 internal marks , awarded through assignments, class participation, and mid-semester work. The external examination carries 45 marks and will be based on the student's understanding of blockchain concepts, principles, and applications, as evaluated in the final university examination.