Department of Computer Science, main campus
UNIVERSITY OF ENGINEERING AND TECHNOLOGY, LAHORE

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CLOs and weekly contents of core and elective courses of CS and SE degree programs for session 2023 and onwards. There are a total of 56 courses including theory and lab courses.

Sr. No.	Course Code	Course Title	Credit Hours	Theory / Lab
1	CSC102	Programming Fundamentals	4 (3-1)	Theory & Lab
2	CSC100	Application of Information and Communication Technologies	3 (2-1)	Theory & Lab
3	CSC101	Discrete Mathematics	3 (3-0)	Only Theory
4	CSC103	Object Oriented Programming	4 (3-1)	Theory & Lab
5	CSC104	Database Systems	4 (3-1)	Theory & Lab
6	CSC105	Digital Logic Design	3 (2-1)	Theory & Lab
7	CSC200	Data Structures and Algorithms	4 (3-1)	Theory & Lab
8	CSC203	Computer Networks	3 (2-1)	Theory & Lab
9	CSC204	Software Engineering	3 (3-0)	Only Theory
10	CSC205	Computer Organization and Assembly Language	3 (2-1)	Theory & Lab
11	CSC201	Information Security	3 (2-1)	Theory & Lab
12	CSC202	Artificial Intelligence	3 (2-1)	Theory & Lab
13	CSC206	Theory of Automata	3 (3-0)	Only Theory

14	CSC208	Design and Analysis of Algorithms	3 (3-0)	Only Theory
15	CSC207	Advanced Database Management Systems	3 (2-1)	Theory & Lab
16	CSC300	Operating Systems	3 (2-1)	Theory & Lab
17	CSC301	Introduction to Human Computer Interaction	3 (3-0)	Only Theory
18	CSC302	Computer Architecture	3 (3-0)	Only Theory
19	CSC303	Compiler Construction	3 (2-1)	Theory & Lab
20	CSC304	Parallel and Distributed Computing	3 (2-1)	Theory & Lab
21	CSC403	Professional Practices in Software Development	2 (2-0)	Only Theory
22	CSC310	Graph Theory	3 (3-0)	Only Theory
23	CSC410	Mobile Application Development	3 (3-0)	Only Theory
24	CSC414	Enterprise Application Development	3 (3-0)	Only Theory
25	CSC415	Web Technologies	3 (3-0)	Only Theory
26	CSC351	Machine Learning	3 (3-0)	Only Theory
27	CSC352	Introduction to Deep Learning	3 (3-0)	Only Theory
28	CSC354	Computer Vision and Image Processing	3 (3-0)	Only Theory
29	CSC451	Natural Language Processing	3 (3-0)	Only Theory
30	CSC380	Introduction to Data Science	3 (3-0)	Only Theory

31	CSC481	Cloud Computing	3 (3-0)	Only Theory
32	CSC482	Internet of Things	3 (3-0)	Only Theory
33	CSC391	Game Development	3 (3-0)	Only Theory
34	SE-211	Software Requirement Engineering	3 (3-0)	Only Theory
35	SE-222	Software Design & Architecture	3 (2-1)	Theory & Lab
36	SE-323	Software Construction and Development	3 (2-1)	Theory & Lab
37	SE-331	Software Quality Engineering	3 (3-0)	Only Theory
38	SE-341	Software Project Management	3 (3-0)	Only Theory
39	SE-442	Software Re-Engineering	3 (3-0)	Only Theory
40	SE-326	Principles of Web Engineering	3 (3-0)	Only Theory

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC102 Programming Fundamentals

Course Description

Programming Fundamentals is the first subject for undergraduate students that introduces the fundamental concepts of structured programming and provides a comprehensive introduction to programming for computer science and technology majors. Topics include data types, control structures, functions, arrays, file handling, 2D arrays and the mechanics of running, testing, and debugging. After completing this course students can develop any business application and any 2D tile-based game on CLI.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Define core programming concepts such as variables, data types, operators, and control structures.	PLO-01	Cognitive	1: Remember
CLO2	Interpret and describe the flow and logic of a given program using pseudocode or source code.	PLO-02	Cognitive	2: Understand
CLO3	Analyze logical and syntactical errors in a given program by applying debugging techniques.	PLO-02	Cognitive	4: Analyze
CLO4	Design and develop a complete program by integrating core programming concepts.	PLO-04	Cognitive	6: Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction. Algorithms and Problem Solving. Hello World, Input/Output. Pseudo-code.	CLO2
2	Algorithms: 1- Input/Output, Arithmetic expressions, Integer division, Modulus operator. 2- Algorithms (Selection): if, if-else. 3- Algorithms (Selection): Nested if-else. 4- Algorithms (Repetition): while loop.	CLO1 CLO2

3	1- Algorithms (Repetition): Counter vs. Sentinel controlled loops, Input validation. 2- Flowchart Introduction to C++: 1- Hello world program, cout, insertion operator. 2- Escape sequences, 3- Variables: Declaration, Variables and Literals, Identifiers	CLO1 CLO2
4	1- Data types (signed, unsigned), char data type. 2- ASCII codes, float, double, bool; sizeof. 3- Assignment & initialization of variables 4- Scope, Arithmetic operators, Comments; 5- Taking input: cin, extraction operator and its properties, Reading different data types, Reading c-strings.	CLO1 CLO2 CLO3
5	1- Operator precedence and associativity. 2- Library functions: pow, sqrt. 3- Type casting(implicit, explicit) 4- Overflow, Underflow. 5- Named constants: const, #define. 6- Multiple assignment and Compound operators, Formatted output, Formatted input: 7- cin.get, cin.getline, cin.ignore,	CLO2 CLO3 CLO4
6	Selection: 1- Relational operators & expressions, Truth values, if, if-else, nested if, if else- if. 2- Selection: Menus, Logical operators, Input validation, Scope, Comparing strings. 3- Conditional operator. 4- switch statement.	CLO2 CLO3 CLO4
7	Repetition: 1- While loop 2- Do-while loop 3- Input validation using while and do-while loop 4- for loop. 5- Sentinel-controlled loops. 6- break, continue. 7- Nested loops.	CLO2 CLO3 CLO4
8	Arrays: 1- Declaration. 2- Input/output. 3- Bounds checking. 4- Initialization. 5- Processing. 6- Assignment. 7- Partially filled arrays	CLO1 CLO2 CLO3 CLO4

9	Midterm Exams	
10	Arrays: 1- Array comparison. 2- Parallel arrays 3- Arrays as function arguments(*after functions). 4- Two-D arrays. 5- Searching arrays(Searching Techniques)	CLO2 CLO3 CLO4
11	Sorting arrays(Sorting Techniques) Enumeration strings Functions: 1- Motivation (Divide & Conquer, Code reuse). 2- Defining. 3- Calling. 4- Function prototype. 5- Sending data into a function. 6- Array as function argument(*)	CLO1 CLO2 CLO3 CLO4
12	Functions: 1- Sending data (Pass-by-value). 2- return. 3- Value-returning functions. 4- Returning a bool value. 5- Local and global variables. 6- Static variables. 7- Default arguments. 8- Pass-by-reference. 9- Function overloading. 10- exit() function. 11- Recursion	CLO2 CLO3 CLO4
13	Files: 1- Text files. 2- Writing data to files. 3- Reading data from files	CLO1 CLO2 CLO3 CLO4
14	Pointers 1- Introduction. 2- & and * operators. 3- Pointers and arrays 4- Pointer arithmetic. 5- Pointer comparison. 6- Pointers as function parameters	CLO1 CLO2 CLO3
15	Pointers: 1- Multiple indirection (pointer to pointer). 2- Dynamic memory allocation (new &delete). 3- Dangling pointers. 4- Memory leak. 5- Dynamic allocation of One-D and Two-D arrays. 6- Returning pointers from functions.	CLO2 CLO3 CLO4

16	Structures: 1- Declaration of struct. 2- Accessing structure members 3- Array as member of struct. 4- Array of structures. 7- Point as member of structure. 8- Pointer to a structure. 9- Returning struct from a function. 10- Struct a parameter of function. 11- When to use .and when -> while accessing struct member. 12- Union 13- Introduction to classes, difference between class, structure and union	CLO1 CLO2 CLO3 CLO4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC102L Programming Fundamentals Lab

Course Description

The objective of the course is to introduce a disciplined approach to Problem solving methods and algorithm development. The aim is to teach the syntax and vocabulary of a modern programming language like C++. The significant philosophies and logical programming, including models for I/O, processing, and all related terminology will be taught. Simple programs will be constructed, using a number of different logical, calculation and algorithm.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO-1	Demonstrate the core programming concepts using algorithmic tools.	PLO-01	Cognitive	2: Understand
CLO-2	Implement control structures such as if-else, switch, and loops to solve structured programming problems.	PLO-03	Cognitive	3: Apply
CLO-3	Evaluate multiple algorithmic approaches implemented using arrays and functions to determine the most efficient and effective solution for given programming problems.	PLO-04	Cognitive	5: Evaluate
CLO-4	Design and develop a modular programming project that integrates core programming constructs in a teamwork.	PLO-06	Cognitive	6: Create
CLO-5	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Problem solving and Algorithms	CLO1
2	Integrated Development Environment (IDE) and Basics of Programming	CLO1
3	Output/ Escape Sequences	CLO1
4	Variables and Data types Named Constants and Type Casting	CLO1

5	Control Structures (if/if-else/if-else-if)	CLO 2
6	Control Structures (switch Statement/Nested if)	CLO 2
7	Control Structures (for/while/do-while loop)	CLO 2
8	Arrays	CLO 3
9	Mid-term	
10	Arrays 2D	CLO 3
11	Functions	CLO 3
12	Searching and Sorting Arrays	CLO 3
13	File Handling	CLO 4
14	Pointers	CLO 4
15	Structures	CLO 4
16	Project Evaluation	CLO 4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC100 Application of Information and Communication Technologies

Course Description

Applications of Information and Computing Technologies is a foundational course designed to provide students with a broad understanding of the fundamental principles and concepts in computer science and technology. The course aims to familiarize students with the core components of computing, programming, and information technology, enabling them to become confident users of technology and fostering an appreciation for its impact on society.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Identify the fundamental components of computer systems and the role of algorithms in computing.	PLO-01	Cognitive	1: Remember
CLO2	Explain the role of Information and Communication Technologies in key sectors such as education, healthcare, business, and governance.	PLO-08	Cognitive	2: Understand
CLO3	Apply basic number systems, Boolean logic, and simple algorithmic procedures to perform data representation and manipulation tasks.	PLO-02	Cognitive	3: Apply

Tentative Weekly Lecture Plan

Week	Topics	Mapped CLO
Week 1	Introduction to Computer Science, Computers, ICT, Hardware and Software	CLO 1
Week 2	The Role and Science of Algorithms, History of Computing, Future Technologies	CLO 1
Week 3	Computer Architecture: Von Neumann Model, Control Unit, Hardware/Software Components	CLO 1

Week 4	Memory Organization, Assembly Language, High-Level Languages, Device Communication	CLO 1
Week 5	Operating Systems: History, Architecture, Process Concepts, Time Sharing, IPC	CLO 1
Week 6	Networking: Classifications, Topologies, Devices (Router, Switch, etc.)	CLO 1
Week 7	Social Repercussions of Computing	CLO 2
Week 8	Problem Solving Concepts: Abstraction, Decision Making, Interfaces (HW + SW perspectives)	CLO 2
Week 9	Midterm Exam	
Week 10	Internet, Mobile & Wireless Communication, IoT, ICT Applications in Sectors	CLO 2
Week 11	Cybersecurity, Risks, Viruses, Encryption, Health Issues	CLO 2
Week 12	Data Storage: Bits, Binary Representation, Binary Addition, Integer Storage	CLO 3
Week 13	Boolean Operations (AND, OR, XOR), Hexadecimal Notation	CLO 3
Week 14	Instruction Categories, Machine Language, Decoding Instructions	CLO 3
Week 15	Web, Mobile, Desktop Apps, E-Applications, Databases, Software Engineering, Challenges	CLO 3
Week 16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC100L Application of Information and Communication Technologies Lab

Course Description

This lab course complements the theoretical coursework by immersing students in a series of guided exercises and projects that reinforce their understanding of documents publishing, presentation, data management, programming, web development, database management, and more. Through interactive sessions, students will engage with industry-standard software tools and technologies, gaining proficiency in areas such as coding, database querying, and web design. The lab fosters collaborative learning as students work on group projects, solving real-world challenges that mirror the complexities of the digital landscape.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Recalling the use of basic computer software tools, including MS Word, PowerPoint, and Excel, to perform fundamental document editing, formatting, and presentation tasks.	PLO-01	Cognitive	1: Remember
CLO2	Apply flowcharting and block-based programming concepts to implement simple interactive logic-based applications.	PLO-02	Cognitive	3: Apply
CLO3	Implement the structure and functionality of basic web pages by integrating HTML and CSS elements to create user-friendly, styled web content.	PLO-03	Cognitive	3: Apply
CLO4	Design and develop small scale applications using structured logic.	PLO-04	Cognitive	6: Create
CLO5	Comply with ethics and professional practices in computing	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Lab Activities / Topics	Mapped CLO
1	Introduction to Windows OS and basic computer software, file types, file management basics	CLO 1

2	MS Word: Interface overview, document creation, editing, text formatting, views, printing	CLO 1
3	MS PowerPoint: Interface, creating presentations, formatting, transitions, SmartArt, multimedia integration, slideshow creation	CLO 1
4	MS Excel (Basics): Spreadsheet creation, editing, formatting, using formula bar, cell formatting, basic math functions	CLO 1
5	Introduction to Scratch: Game logic, interface, control blocks, sprites, basic program development	CLO 2
6	Scratch Advanced: Backgrounds, sound effects, sprite control, demo games (e.g., racing game, quiz game)	CLO 2
7	Scratch Project: Students present simple games created in Scratch with PPT-based project presentation	CLO 2
8	Microsoft Access: Table creation, field properties, simple queries	
9	Midterm Exam	
10	HTML Introduction: Structure, headings, font styles, forms	CLO 3
11	HTML Continued: Controls, image formatting, hyperlinks, tables, divisions, lists	CLO 3
12	CSS Styling: Inline, internal, external CSS, applying styles to tables, forms, divisions	CLO 3
13	Python Basics: Syntax, variables, data types	CLO 3
14	Python Basics: Expressions, basic input/output	CLO 4
15	Python Advanced: Loops, lists, sets, dictionaries, problem-solving lab task	CLO 4
16	Project Evaluation	CLO-1,2,3,4,5

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC101 Discrete Mathematics

Course Description

This course introduces foundational concepts in logic, set theory, and methods of proof. Topics include combinatorics, number theory, recurrence relations, and graph theory. Emphasis is placed on mathematical reasoning, algorithmic thinking, and problem-solving relevant to computer science.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO-1	Explain fundamental concepts of logic and set theory to construct and evaluate mathematical arguments.	PLO-01	Cognitive	2: Understand
CLO-2	Apply counting principles and modular arithmetic to solve combinatorial problems.	PLO-02	Cognitive	3: Apply
CLO-3	Apply recursive methods and mathematical techniques, including recurrence relations and modular arithmetic, to design and solve computational problems	PLO-02	Cognitive	3: Apply
CLO-4	Explain graph theory concepts and matrix representations to model network problems.	PLO-04	Cognitive	2: Understand
CLO-5	Apply mathematical proofs using induction and the well-ordering principle.	PLO-02	Cognitive	3: Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
Week 1	Introduction to Discrete Mathematics & Motivation, Sets, Comparing and Combining Sets, Power Set, De Morgen's Law and Proof, Cartesian Product and Ordered Pairs	CLO-1
Week 2	Relations, Arrow Diagram for Relations, Functions, Type of Functions, Inverse Functions,	CLO-1
Week 3	Introduction to logic, Statements, Compound Statements (Conjunction, Disjunction and Negation), Truth Table and Values, Propositional Logic, Logical Equivalence, Tautology and Contradictions	CLO-1
Week 4	Conditional Statements (Implication), Converse and Inverse, Biconditionals, Necessary and Sufficient (If and only if), Validity of	CLO-1

	Arguments (Modus Ponens and Modus Tollens), Logical Fallacy, Rules of Inference	
Week 5	Sequences and Series, Mathematical Induction, Proof by Induction, Well- Ordering Principle	CLO-5
Week 6	Defining Sequences Recursively, Solving Recurrence Relations (Iteration, Tree and Master method), Tower of Hanoi, Fibonacci Numbers	CLO-3
Week 7	Language of Congruence, Modular Arithmetic, Multiplicative Inverse, Euclidean and Extended Euclidean Algorithm	CLO-2, CLO-3
Week 8	Modular Arithmetic for Cryptography, Number Theoretic Methods of Proof	CLO-2
Week 9	Midterm	
Week 10	Counting and Probability, Multiplication Rule, Sampling, The Pigeonhole Principle, The Birthday Problem	CLO-2
Week 11	Combinations and Permutations, Pascal's Formula and Binomial Theorem, Probability Axioms and Expectation	CLO-2
Week 12	Introduction to Linear algebra, Vectors, matrices and Linear Combinations, Vector Spaces	CLO-2
Week 13	Graph Types, Graph Applications, Paths and Circuits, Eulerian and Hamiltonian Circuits	CLO-4
Week 14	Matrix Representation of Graphs, Adjacency list/incidence matrix, Isomorphism of Graphs, Connectivity	CLO-4
Week 15	Trees o Spanning Trees o Minimum spanning trees o Tree connectivity o Dijkstra Algorithm	CLO-4
Week 16	Trees and Types, Tree Traversal, Minimum Spanning Tree, Prim and Kruskal algorithm for MST calculation	CLO-4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC103 Object Oriented Programming

Course Description

This course introduces object-oriented programming principles, contrasting them with structured and unstructured programming paradigms. Students will learn to implement OOP techniques, including classes, constructors, destructors, dynamic memory, operator overloading, and function overloading. Key topics include: OOP Principles: Core concepts like encapsulation, inheritance, and polymorphism; Implementation: Hands-on development of object-oriented programs; Design: Creating class hierarchies and exploring object relationships while identifying design flaws and improvement opportunities. By the end, students will be prepared to create efficient and maintainable object-oriented software.

Course Learning Outcomes

CLOs	Description	PLOs	Domain	Level
CLO-1	Explain object-oriented programming principles and contrast them with structured and unstructured programming paradigms.	PLO-01	Cognitive	2: Understand
CLO-2	Implement object-oriented programs using classes, constructors, destructors, dynamic memory, operator overloading, and function overloading.	PLO-02	Cognitive	3: Apply
CLO-3	Design and develop class hierarchies and object relationships (composition, inheritance, polymorphism, template classes), identifying potential design flaws and opportunities for improvement.	PLO-04	Cognitive	6: Create

Weekly Content		
Week	**Topics**	**CLO**
Week 1	Revision of pointers and dynamic memory allocation. Difference between nonstructured programming, structured programming and Object-Oriented Programming and problem solving. Where to store Structural, Behavioural and Capabilities with limitation and constraints. Object oriented approach to programming with Concepts of Object Orientation, e.g., Protection, Encapsulation, Abstraction, Messaging.	CLO1
Week 2	Migration from modular program having structures and functions to Classes & Object: syntax and semantics. Implicitly available member functions. Default constructor, copy constructor, destructor, = assignment operator, & address-of operator. Access modifiers: public, private.	CLO1
Week 3	Programmer defined constructor, copy constructor, destructor, assignment operator(=). Overloading constructors. Shallow and deep objects. Constructor's initializer list.	CLO1
Week 4	Separate declaration and definition of member functions. Accessors, utility methods, objects as argument and return type. Cascaded calls to functions;	CLO2

Week 5	Static members, const members, objects members; Constructor's initializer list revisited; uses of implicit this pointer/reference or me reference	CLO2
Week 6	Arrow (->) operator, dynamic memory allocation with new operator to instantiate objects in the system heap and de-allocation of object memory with delete operator.	CLO2
Week 7	Operator Overloading: operator as member functions; Cascaded calls to operator functions;	CLO2
Week 8	Operators as friend functions; Restriction on friend operator functions [],(), ->	CLO2
Week 9	Midterm	
Week 10	Composition and related concepts; Has-a relationship. Complex object. Partial classes	CLO3
Week 11	Composition and related concepts; Has-a relationship. Complex object. Partial classes	CLO3
Week 12	Inheritance: private and protected access modifiers. Is-a Relationship of base class and derived classes, Derived class functions overloading. Data member domination.	CLO3
Week 13	Inheritance: Member function overriding; virtual functions; pure virtual functions	CLO3
Week 14	Abstract classes; Concrete classes; Class hierarchy. Multiple inheritance; Diamond head problem;	CLO3
Week 15	Polymorphism: how to implement; compilation advantage.	CLO3
Week 16	Template functions and classes	CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC103L Object Oriented Programming Lab

Course Description

This course focuses on the theoretical foundations of object-oriented programming (OOP), highlighting class design and hierarchy development. Students will learn testing and debugging techniques to ensure program reliability while adhering to ethical standards. Key topics include: OOP principles and class development; Effective testing and debugging; Efficient design and memory management; Professional ethics in computing. Students will gain essential skills for creating high-quality software.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO-1	Apply object-oriented principles to develop classes and class hierarchies.	PLO-01	Cognitive	3. Apply
CLO-2	Test and debug object-oriented programs using appropriate software tools and techniques to ensure correctness and reliability.	PLO-05	Cognitive	5. Evaluate
CLO-3	Design and develop object-oriented programs having correct design with optimal memory management.	PLO-04	Cognitive	6. Create
CLO-4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Functions: prototype, definition, and call. Function parameter types: in, in-out and out only, value type, reference type. Reference and pointer differentiated. Runtime code segment and data segment explained. System Heap and Stack explained. Object oriented approach to programming with Concepts of Object Orientation, e.g, Protection, Encapsulation, Abstraction, Messaging.	CLO1, CLO2
2	Migration from modular program having structures and functions to Classes & Object: syntax and semantics. Implicitly available member functions. Default constructor, copy constructor, destructor, = assignment operator, & address-of operator. Access modifiers: public, private.	CLO1, CLO2

3	Programmer defined constructor, copy constructor, destructor, assignment operator(=). Overloading constructors. Shallow and deep objects. Constructor's initializer list.	CLO1, CLO2
4	Separate declaration and definition of member functions. Accessors, utility methods, objects as argument and return type. Cascaded calls to functions.	CLO1
5	Static members, const members, objects members; Constructor's initializer list revisited; uses of implicit this pointer/reference or me reference	CLO3, CLO2
6	Arrow (->) operator, dynamic memory allocation with new operator to instantiate objects in the system heap and de-allocation of object memory with delete operator.	CLO3, CLO2
7	Operator Overloading: operator as member functions; Cascaded calls to operator functions;	CLO3, CLO2
8	operators as friend functions; Restriction on friend operator functions [],(), ->	CLO1, CLO2
9	Mid-term	
10	Composition and related concepts; Has-a relationship. Complex object. Partial classes	CLO3, CLO2
11	Composition Cont. (Association and Aggregation).	CLO3, CLO2
12	Inheritance: private and protected access modifiers. Is-a Relationship of base class and derived classes, Derived class functions overloading. Data member domination.	CLO1, CLO2
13	Inheritance: Member function overriding; virtual functions; pure virtual functions	CLO1, CLO2
14	Inheritance: Member function overriding; virtual functions; pure virtual functions	CLO1, CLO2
15	Polymorphism: how to implement; compilation advantage.	CLO1, CLO2
16	Template functions and classes	CLO3, CLO2

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC104 Database Systems

Course Description

This course introduces the fundamentals of database systems, covering database applications, relational concepts, and structured query language (SQL) for data definition, manipulation, and advanced querying. Students will learn ER and EER modeling, apply relational algebra, and perform normalization to eliminate redundancy and ensure data integrity. The course also explores views, constraints, triggers, semi-structured data XML/JSON, NoSQL models, and core concepts in data storage and security. By the end, students will be able to design, normalize, and query relational databases effectively.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Describe core database concepts, components, and data models.	PLO-01	Cognitive	2: Understand
CLO2	Use Structured Query Language (SQL) to define, manipulate, and retrieve data from relational databases.	PLO-02	Cognitive	3: Apply
CLO3	Build relational schemas from conceptual models using ER and normalization concepts.	PLO-04	Cognitive	3: Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Overview of Databases and Applications: Database purpose, real-world use cases, file vs database systems, DBMS types	1
2	Relational Database Concepts: Tables, tuples, attributes, schema, keys, integrity constraints	1
3	SQL: Create, insert, update, delete; simple queries with SELECT	2
4	SQL: Selection, Projection, WHERE, ORDER BY, JOINs	2
5	Advanced SQL Queries: Aggregation, GROUP BY, HAVING, nested subqueries, set operations	2
6	Views, Constraints, Triggers: Creating views, enforcing integrity constraints, simple triggers	2
7	Relational Algebra: Selection, projection, joins, union, difference, Cartesian product, division	2

8	Entity Relationship (ER) Modeling: Entities, attributes, relationships, ER diagram drawing	3
9	Midterm Exam	
10	Enhanced ER Modeling (EER): Generalization, specialization, aggregation, hierarchy, subclasses, categories, inheritance	3
11	Normalization: anomalies, dependency analysis	3
12	Normalization & Higher Normal Forms: 1NF, 2NF, 3NF, BCNF, anomalies, dependency analysis	3
13	XML, JSON: Semi-structured data formats	1
14	NoSQL: document stores, key-value pairs	1
15	Data Storage & Security: File organization, access paths, data encryption, user roles and access control	1
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC104L Database Systems Lab

Course Description

This lab course offers practical experience in database design and implementation using SQL Server. Students will work with DDL and DML commands, joins, constraints, aggregate functions, views, triggers, and stored procedures. They will also design ER/EER diagrams, perform normalization, and explore semi-structured data using XML/JSON and NoSQL. The course concludes with a database project where students apply their skills to build a complete database solution.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Demonstrate the use of Relational, XML, JSON, and NoSQL databases for managing data.	PLO-01	Cognitive	2. Understand
CLO2	Apply Structured Query Language (SQL) to define, manipulate and retrieve data using DDL, DQL and DML operations	PLO-02	Cognitive	3. Apply
CLO3	Design relational schemas from conceptual models using ER and normalization concepts.	PLO-04	Cognitive	6. Create
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Comparison of DBS with FBS	1
2	Introduction and installation of SQL Server	1
3	DDL statements in SQL server, create, alter and drop commands in sql server	2
4	SQL server data types, use of DDL and DML statements. SQL Basics-DML (Constraints, PK, FK, Select)	2
5	Joins	2
6	Aggregate functions, Operators, Nested queries	2

7	Views, Triggers and stored procedures	2
8	Entity Relationship Diagram	3
9	Midterm Exams	
10	Enhanced Entity Relationship Diagram	3
11	Dependency analysis and anomaly detection	3
12	Normalization	3
13	XML/JSON	1
14	NoSQL	1
15	Project	2,3
16	Revision	1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC105 Digital Logic Design

Course Description

Digital Logic Design introduces the fundamentals of digital systems, including number systems, Boolean algebra, logic gates, combinational and sequential circuits, and memory elements. Students learn to analyze and design digital circuits using theoretical and practical approaches, often with simulation tools.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Perform mathematical computations in Boolean algebra and various number systems like Binary, Octal and Hexadecimal.	PLO-01	Cognitive	3: Apply
CLO2	Analyze digital circuits in combinational and sequential logic.	PLO-02	Cognitive	4: Analyze
CLO3	Design combinational and sequential logic circuits from functional description of digital systems.	PLO-03	Cognitive	6: Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Number Systems: Digital Computers, Arithmetic Operations, Decimal, Alphanumeric, and Gray Codes.	1
2	Boolean Algebra and Binary Logic with arithmetic operations	1
3	Binary Gates, Truth Tables, Standard Forms for optimization	2
4	Combinational Logic Circuits: Mapping techniques, Karnaugh maps, Optimization techniques.	1,2
5	Combinational Logic Circuits: Design Steps from given specification to hardware implementation and verification	3
6	Combinational System Decoders, Encoders, Multiplexers, De-Multiplexers	2
7	Arithmetic Operations: Adders, Subtractors, Signed Addition/Subtraction, Binary Adders implementation	2

8	Combination Logic Design: Implementation of function using Decoders, multiplexers from functional description	3
9	Mid Term	
10	Sequential Circuits: Basic Latches and SR, D, JK and T Flip-Flops	2
11	Sequential System: Analysis of clocked sequential circuits, State assignment, state tables, state diagrams, Use of FF tables	2
12	Sequential Logic System: Design procedure, FF Excitation Tables, Design using Functional description to State diagram. State diagram to hardware implementation and verification	3
13	Digital Logic Design: Construction of gates using CMOS, Timing problems, Metastability	1
14	PLDs: Programmable Logic Devices, Gate Arrays, Design using ROM, PLA, PAL	3
15	Registers and Counters: Introduction, Registers, Shift and Multi-mode registers, Ripple and Synchronous counters.	3
16	FSM: Basic introduction of Finite state machine and its design	3
17	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC105L Digital Logic Design Lab

Course Description

This lab provides practical experience in designing and analyzing digital logic systems. Students will explore number systems, logic gates, and Boolean algebra, progressing to the implementation and simplification of combinational circuits using techniques such as Karnaugh Maps (K-Map) and the Quine–McCluskey method. The lab also covers sequential logic design, including flip-flops, latches, counters, shift registers, and synchronous/asynchronous circuits. Students will design binary arithmetic circuits and understand the behavior of memory elements and state machines.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Implement basic logic gates and Boolean expressions using combinational and MSI circuits through simulation in Proteus.	PLO-01	Cognitive	3: Apply
CLO2	Assemble digital circuits for arithmetic and logic operations.	PLO-03	Psychomotor	2: Manipulation
CLO3	Calibrate digital circuits for real-world applications with accuracy.	PLO-04	Psychomotor	3: Precision
CLO4	Document and present technical information effectively in a structured report.	PLO-07	Cognitive	2: Understand
CLO5	Comply with ethics and professional practices in computing.	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction and implementation of basic logic gates	1
2	Implementation of Basic Gates using Universal Gates NAND or NOR	1
3	Realization and implementation of Boolean functions using gates	1, 2
4	Implementation of Adder and Subtractor using basic gates and universal gates	1, 2

5	Implementation of Binary code decimal to an excess-III circuit using adders and K-maps	1, 2
6	Implementation of Binary to Gray code	1, 2
7	Implementation of Multiplexers and De-Multiplexers using basic gates	1, 2
8	Implementation of Comparator circuits and its applications in various areas	1, 2
9	Mid Term Week	
10	Implementation of BCD to 7- segment decoding	1, 2
11	Implementation of Encoder and Decoder	1, 2
12	Implementation of Latches and its Proteus simulation using logic gates	1
13	Implementation of Flip-Flop and Its Application and Proteus Simulation	1
14	Understanding and implementation of Registers	1, 2
15	Understanding and implementation of Counters	1, 2
16	Lab Revision / Project	1, 2, 3, 4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC200 Data Structures and Algorithms

Course Description

This course provides a theoretical foundation in data structures and algorithms, focusing on their design, analysis, and mathematical modeling. Students will learn to evaluate the efficiency of algorithms using asymptotic notation, explore fundamental abstract data types (ADTs), and understand how different data structures optimize computational tasks. Students will explore abstract data types (ADT), recursion, algorithm complexity, and the implementation of key structures like stacks, queues, trees, graphs, and hash tables. This course also emphasizes problem-solving techniques and complexity analysis for classical algorithms.

Course Learning Outcomes (CLOs)

CLO No.	Description	PLOs	Domain	Domain Level
CLO1	Describe and explain fundamental data structures (arrays, lists, stacks, queues, trees, graphs, hash tables), their operations and applications.	PLO-01	Cognitive	2: Understand
CLO2	Analyze the performance of data structures to determine their time and space complexity.	PLO-03	Cognitive	4: Analyze
CLO3	Design efficient solutions for complex problems by selecting suitable data structures and algorithms based on specific requirements.	PLO-04	Cognitive	6: Create

Tentative Weekly Lecture Plan

Week	Topics	Mapped CLOs
Week 1	Introduction to Data Structures and Algorithms ADTs, need for structured data	CLO1
Week 2	Overview of time/space complexity (Big-O, Big-Ω, Big-Θ), Searching (Linear, Binary) and Sorting Algorithms (Bubble, Insertion, Selection)	CLO2
Week 3	Arrays and Strings Operations, limitations, applications	CLO1, CLO2, CLO3
Week 4-5	Linked Lists Singly, Doubly, Circular, memory model, use cases	CLO1, CLO2, CLO3

Week 6	Stacks Array vs. linked-list implementation, applications (expression evaluation and conversion, undo)	CLO1, CLO2, CLO3
Week 7	Queues and Priority Queues Circular queue, dequeue, priority concepts	CLO1, CLO2, CLO3
Week 8	Recursion Stack frame model, recursion vs. iteration, Merge Sort, Quick Sort; comparative analysis	CLO1, CLO2
Week 9	Midterm	
Week 10	Trees Binary Tree, Binary Search Tree (BST), traversal algorithms	CLO1, CLO2, CLO3
Week 11	Balanced Trees AVL Trees, rotations, balance factor	CLO1, CLO2, CLO3
Week 12	Heaps and Heap Sort Min/max heaps, heap-based priority queues	CLO1, CLO2, CLO3
Week 13	Hash Tables Hash functions, collision handling (chaining, open addressing)	CLO1, CLO2, CLO3
Week 14	Graphs I Representations (adjacency list/matrix), BFS/DFS	CLO1
Week 15	Graphs II Shortest Path Algorithms (Dijkstra), connected components	CLO1
Week 16	Algorithms comparative analysis	CLO2

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC200L Data Structures and Algorithms Lab

Course Description

This lab course complements the Design and Analysis of Algorithms by providing hands-on experience in implementing and testing classical algorithms. Students use programming to solve problems related to sorting, searching, graph algorithms, dynamic programming, and greedy techniques. The lab emphasizes algorithm efficiency and performance analysis.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Implement fundamental data structures such as arrays, lists, stacks, and queues, trees, graphs, and hash tables.	PLO-01	Cognitive	3: Apply
CLO2	Compare the performance of algorithms using test cases and input data sets.	PLO-03	Cognitive	4: Analyze
CLO3	Design and develop solutions for complex computing problems using suitable data structures.	PLO-04	Cognitive	6: Create
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Lab Topic	Mapped CLO(s)
1	Introduction to Lab Tools & Programming Setup Simple Searching Algorithms (Linear, Binary)	CLO1 CLO2
2	Sorting Algorithms (Bubble, Selection, Insertion)	CLO1, CLO2
3	Arrays and String Manipulation	CLO1, CLO3
4-5	Linked Lists (Singly, Doubly, Circular)	CLO1, CLO3
6	Stack Implementation & Applications	CLO1, CLO3
7	Queue and Circular Queue	CLO1, CLO3
8	Recursion (Merge sort, Quick Sort)	CLO1, CLO2

9	Midterm	
10	Binary Trees & Tree Traversals	CLO1, CLO2
11	AVL Trees / Balanced Tree	CLO1, CLO3
12	Min-Heap / Max-Heap and Heap Sort	CLO2, CLO3
13	Hash Tables with Collision Handling	CLO1, CLO3
14	Graph Representation (Adjacency Matrix/List)	CLO1
15	Dijkstra's Algorithm & Shortest Path Visualization	CLO1
16	Performance Analysis of Data Structures and Algorithms	CLO2

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC203 Computer Networks

Course Description

The Computer Networks course introduces students to the fundamentals of data communication and networking. It covers key concepts such as network architectures, protocols, OSI and TCP/IP models, IP addressing, routing, switching, and network security. Students learn how data is transmitted across networks, the role of different networking devices, and how networks are designed, managed, and troubleshooted.

Measurable Student Learning Outcomes

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain fundamental networking concepts, architectures, and the roles of OSI and TCP/IP layers.	PLO-01	Cognitive	2. Understand
CLO2	Analyze network protocols based on network performance requirement at application and transport layers.	PLO-03	Cognitive	4. Analyze
CLO3	Apply IP addressing, subnetting, and routing principles to solve communication problems at network and datalink layers.	PLO-02	Cognitive	3. Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	What Is the Internet? A Nuts-and-Bolts Description A Services Description What Is a Protocol? The Network Edge The Network Core Delay, Loss, and Throughput in Packet-Switched Networks	1
2	Protocol Layers and Their Service Models Networks Under Attack History of Computer Networking and the Internet	1
3	Application layer Principles of Network Application The Web and HTTP	2
4	Web Cache Electronic Mail in the Internet, SMTP	2

	File Transfer: FTP (using TCP)	
5	DNS Transport Layer Services Multiplexing and Demultiplexing	2
6	Principles of Reliable Data Transport, TCP Principles of Congestion Control, TCP Congestion Control	2
7	Network Layer: Virtual Circuits and Datagram Networks, Inside a Router Details of the Internet	3
8	IP Subnetting and design of wide area network	3
9	Mid-Term	
10	Details of the Internet Protocol (IP)	3
11	Routing Algorithms: Link State, Distance Vector	3
12	Routing in the Internet Routing Information Protocol (RIP) Open Shortest Path First (OSPF)	3
13	Border Gateway Protocol (BGP)	3
14	Link Layer Error Detection and Correction Multiple Access Protocols	3
15	Network Devices at link layer switches, switch learning, campus area networks VLANs	3
16	Multiprotocol Label Switching (MPLS)	3
17	Revision	1, 2, 3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC203L Computer Networks Lab

Course Description

The Computer Networks Lab course provides hands-on experience with networking concepts and technologies. Students learn to design, configure, and troubleshoot various types of networks using tools like Wireshark. The course covers key topics including IP addressing, subnetting, routing protocols, and network security. Through practical experiments, students develop skills in setting up LANs, VLANs, and wireless networks. Emphasis is placed on real-world scenarios and problem-solving, preparing students for industry certifications and careers in networking and IT infrastructure. The lab complements theoretical knowledge with essential technical expertise.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Demonstrate understanding of fundamental networking concepts including protocols, addressing, and topologies.	PLO-01	Cognitive	2. Understand
CLO2	Apply sniffing and simulation tools to examine internet traffic and evaluate network performance.	PLO-05	Cognitive	3. Apply
CLO3	Create small-scale network scenarios using real or simulated devices to reinforce applied networking concepts.	PLO-04	Cognitive	6. Create
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Lab contents and Introduction to Cisco Packet Tracer Different network connections and simulations (PC to PC, Hub, and Switch) PC Configurations (IP and default subnet mask)	1
2	Concept of LAN and WAN Different network topologies using hub, switches, and router (with default configurations) and simulations (unicasting and broadcasting) Topologies covered: Bus, Star, Ring, Mesh	1

3	Socket Programming (TCP) Daytime Client Echo Server Home task from reference book (Mail Client, Proxy Server)	1, 2
4	Socket Programming (UDP) Daytime Client Echo Server Chat Application	1, 2
5	Introduction to Wireshark Packet Capturing and Analyzing real time HTTP traffic proxy server, Web Server	2
6	Wireshark (HTTP) Packet Analysis	2
7	Wireshark (DNS) Packet Analysis	2
8	Networking diagnostic tools with various networking commands through command prompt (remote login on Packet tracer)	1
9	Mid Term Week	
10	DHCP, FTP, Web Server, HTTP Server (Application Layer Protocols) using Cisco Packet Tracer	2
11	Configuration of Switch and Routers through CLI remote login and telnet session	1
12	IPv4 addressing, subnetting	1
13	Classless addressing IPv4 Subnetting (VLSM) with simple network topology on packet tracer	3
14	Router Configuration (Static, RIP, OSPF)	3
15	Virtual LANs (VLANs)	3
16	Revision	1, 2, 3
17	Lab Project	3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC204 Software Engineering

Course Description

This course is intended to provide students with an understanding of the concepts and methods for the definition, development and maintenance of software systems. The course discusses important software development activities, emphasizing on analysis, design, and testing. The objective is to inculcate a disciplined approach to software development, enabling students to effectively use this approach to develop software.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Discuss requirements engineering for a software product.	PLO-01	Cognitive	2. Understand
CLO2	Apply appropriate software development life cycle model for a given software project.	PLO-03	Cognitive	3. Apply
CLO3	Apply Unified Modeling Language to design a software.	PLO-04	Cognitive	3. Apply
CLO4	Validate the quality of a software at module, integration, and system granularity levels.	PLO-04	Cognitive	5. Evaluate

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Software Engineering Proposal Writing Requirement Specification	1
2	Usage of Project Management Tools Software Engineering Framework Types of Requirements Scope and Vision of a Project	1
3	User Consideration (Stack holders) Use Cases Wireframes	1
4	Story boarding User Stories Prototyping	1
5	Software Development Life Cycle (SDLC) Waterfall Model	2

	Incremental Model Big Bang Model	
6	Spiral Model V-Model Agile Model	2
7	Rapid Application Development Model Prototyping Model	2
8	Project Planning Software Architecture Software Design Principles	3
9	Midterm Exams	
10	Use Case Diagram Class Diagram Object Diagram	3
11	Sequence Diagram Collaboration Diagram Deployment Diagram Component Diagram	3
12	Activity Diagram State Machine Diagram Package Diagram	3
13	System Testing Component Testing	4
14	Test Case Design Test Automation	4
15	Introduction to Design Patterns Best Software Design and Development Practices	1,2,3,4
16	Software Deployment Configuration Management	1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC205 Computer Organization and assembly language

Course Description

This course will provide an overview of organization and function of computers at microprocessor level and how data and program instructions are represented at machine level. The students will learn to program in assembly language for 16, 32 and 64-bit processors.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain how data types, registers, instruction sets, addressing modes, and memory models support data representation and instruction execution in computer systems.	PLO-01	Cognitive	2: Understand
CLO2	Apply assembly language programming constructs to implement solutions to the computing problems	PLO-02	Cognitive	3: Applying
CLO3	Design and develop modular assembly language programs that interact with system-level components.	PLO-04	Cognitive	6: Creating

Tentative Weekly Lecture Plan

Week	Content	Mapped CLO
1	Computer Organization, Components of a Computer System, Brief Introduction to Number System & Their Arithmetic, Data Representation & Organization	CLO-1
2	Assembly and Machine Language, Instruction Format (3-address, 2-address etc.)	CLO-1
3	x86 Processor Architecture, Buses, Processor Registers (16, 32, 64-bits), Addressing Modes (Direct, Indirect etc.), Memory Organization	CLO-1
4	Assembly Language Fundamentals, Integer Expressions, Directives, Reserved Words etc., Instruction Format (1-operand, 2-operand etc.), Basic Programs	CLO-2

5	Assembling, Linking Programs, Defining Data, Data Operators, Arrays in Assembly Language, Indirect Addressing, JMP and Loop Instructions	CLO-2
6	Conditional branching, Boolean and comparison instructions, Conditional loop instructions, Loop instructions, Control flow directives	CLO-2
7	Stack Operations, PUSH and POP Instructions, Linking to External Library	CLO-3
8	Defining Procedures, Nested Procedure Calls, Passing Register Arguments to Procedures	CLO-2
9	Midterm Exam	
10	Advanced Procedures, INVOKE, ADDR, PROC and PROTO directives	CLO-3
11	Creating multi-module programs, Advanced use of parameters	CLO-3
12	Shift and rotate instructions, Signed Overflow, Shifting Multiple Doublewords	CLO-2
13	Multiplication and division instructions,	CLO-2
14	Structures and macros, String and array operations, String primitive instructions	CLO-3
15	16-bit MS-DOS programming, INT21h interrupt.	CLO-3
16	FPU components, Floating point instructions	CLO-2

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC205L Computer Organization and Assembly Language Lab

Course Description

This course will provide an overview of the structure and function of computers at the level of microprocessors and how data is represented at this level. Main topics of the course are: organization of computer hardware, the functions of assembler, linker, and loader, basic assembly language instruction set, memory management, addressing modes, stack, and procedures, low-level I/O. Students will learn to design, implement, and debug programs in assembly language.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Use an assembler and debugger to execute basic assembly language programs.	PLO-01	Cognitive	3: Apply
CLO2	Analyze assembly language programs that use control structures, procedures, and stack operations with appropriate development tools	PLO-03	Cognitive	4: Analyzing
CLO3	Design and develop assembly language-based solutions to the given problems	PLO-04	Cognitive	6: Creating
CLO4	Comply with ethics and professional practices in computing	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Lab Title	Mapped CLO
1	Configuring NASM Assembler on Visual Studio	CLO-1
2	Basic Assembly Program Structure and Data Representation	CLO-1
3	Basic Assembly Instructions and Integer Expressions	CLO-1
4	Arrays, JMP and Loop Instructions	CLO-1
5	Conditional Branching and Comparison	CLO-2
6	Stack Operations and External Library Usage	CLO-2
7	Defining and Calling Procedures	CLO-2

8	Midterm Evaluation	CLO-2
9	Midterm Lab Exam / Practice Session	CLO-1,2
10	Advanced Procedure Handling, Multi-Module Programs	CLO-3
11	Shift and Rotate Instructions	CLO-3
12	Multiplication and Division	CLO-3
13	Macros and String Operations	CLO-3
14	MS-DOS Interrupts and Real Mode Programming	CLO-3
15	Floating Point Operations	CLO-3
16	Project Evaluation	CLO-1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC201 Information Security

Course Description

Information Security introduces principles and practices for protecting digital information. Topics include cryptography, network security, authentication, access control, and risk management. Students learn to identify threats, secure systems, and apply security protocols to real-world scenarios.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain fundamental concepts, principles, and models in information security.	PLO-01	Cognitive	2. Understand
CLO2	Apply common tools, techniques, and frameworks to address information security problems.	PLO-02	Cognitive	3. Apply
CLO3	Apply knowledge of security threats in alignment with legal, ethical, and professional standards.	PLO-03	Cognitive	3. Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Information Security, CIA Triad, Threats, Terminology	1
2	Security Goals, Models (Bell-LaPadula, Biba), and Access Control Mechanisms	1
3	Risk Management, Security Policies, and Principles of Secure Design	1
4	Cryptography Basics: Concepts, Classical Ciphers, Ceaser Cipher, Substitution	1, 2
	DES Structure, Modes of Operation	
5	AES	1, 2
6	Asymmetric Cryptography: RSA, Diffie-Hellman, Key Management	1, 2
7	Authentication Mechanisms (Biometrics) and Access Control Implementation	2

8	Hash Functions and Digital Signatures	1, 2
9	Mid Term	
10	Network Security Tools: Firewalls, IDS/IPS, VPNs	2
11	Web and Software Security: TLS/SSL, Session Management, Common Web Attacks (XSS, SQLi, CSRF)	2
12	Application Layer Protocols and Email/Web Security (DNSSEC, HTTPS, SPF, DKIM)	2
13	Introduction to Common Threats and Vulnerability Classes (OWASP Top 10, Malware Types)	3
14	Legal, Ethical, and Professional Issues in Cybersecurity (PECA 2016, GDPR, Cyber Ethics)	3
15	Emerging Trends: IoT Security, Cloud Security, AI in Cyber Defense (Presentations)	3
16	Emerging Trends: IoT Security, Cloud Security, AI in Cyber Defense (Presentations)	3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC201L Information Security Lab

Course Description

This lab course provides practical experience to reinforce foundational and advanced concepts in information security. Through hands-on activities and simulations, students will apply core security principles using modern tools and environments. The lab emphasizes the implementation and testing of cryptographic techniques, digital signatures, and secure communication. Students will gain experience with authentication mechanisms, access control models, and threat detection techniques. Additional focus is placed on analyzing software and network vulnerabilities, configuring firewalls and intrusion detection systems, and exploring ethical hacking practices. Real-world security challenges such as malware analysis, database protection, and legal/ethical implications of cybersecurity are introduced through guided labs and case-based learning.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Demonstrate basic cryptographic processes including encryption, decryption, and hashing through guided tools.	PLO-01	Cognitive	2. Understand
CLO2	Apply security mechanisms for implementing authentication, access control, and secure communication.	PLO-02	Cognitive	3. Apply
CLO3	Analyze practical scenarios to identify common security threats and evaluate basic countermeasures.	PLO-03	Cognitive	4. Analyze
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to lab environment: Linux terminal, virtual lab setup (VM, online labs)	CLO1
2	Demonstrating confidentiality, integrity, and availability (CIA triad) through simple file-based and simulated attacks	CLO1
3	Implementing access control: user roles, permissions, and basic security policies in Linux	CLO2

4	Classical encryption: Caesar, monoalphabetic, and substitution ciphers using CrypTool or Python	CLO1
5	DES and AES encryption/decryption using OpenSSL or Python	CLO1
6	RSA and Diffie-Hellman key exchange with OpenSSL / Python	CLO1
7	Authentication mechanisms: password hashing (bcrypt/sha512), 2FA simulation, and password cracking demo (e.g., John the Ripper)	CLO2
8	Hashing & digital signatures: MD5, SHA-256, and digital signature verification with OpenSSL or Python	CLO1, CLO2
9	Mid Term Week	
10	Network traffic analysis using Wireshark (HTTP, DNS, FTP) to explore vulnerabilities	CLO3
11	Secure communication: TLS/SSL handshake analysis via browser and OpenSSL demo	CLO2, CLO3
12	Web/email security: DNS spoofing, SPF/DKIM record checks, email header analysis	CLO2, CLO3
13	Network scanning and threat identification using Nmap or Zenmap	CLO3
14	Vulnerability scanning and basic exploitation demos using OWASP ZAP or Nessus (demo mode)	CLO3
15	Case study analysis: real-world attack (e.g., WannaCry or Target breach) + discussion	CLO3, CLO4
16	Final Lab Project	CLO1, CLO2, CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC202 Artificial Intelligence

Course Description

This course introduces the fundamental concepts of Artificial Intelligence, including knowledge-based systems, reasoning, and problem-solving using search techniques. Topics include informed and uninformed search, heuristics, and game-playing algorithms such as Minimax and Alpha-Beta Pruning. Python is used to implement and explore core AI techniques and applications.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Define the fundamental concepts of artificial intelligence.	PLO-01	Cognitive	2. Understand
CLO2	Explain various approaches to knowledge representation and reasoning used in artificial intelligence systems.	PLO-02	Cognitive	2. Understand
CLO3	Perform informed, uninformed search, adversarial local search strategies algorithms to solve goal-oriented problems.	PLO-03	Cognitive	5. Evaluate
CLO4	Apply machine learning techniques and assess their applicability in solving real-world AI problems.	PLO-04	Cognitive	3.Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Artificial Intelligence: History, Goals, Applications, Different AI Approaches, Turing Test, Rational Agents Intelligent Agents, The Concept of Rationality, The Nature of Environments, The Structure of Agents	CLO1
2	Solving Problems by Searching, Problem-Solving Agents, Problem Formulation, Search spaces, State space, Search Trees, Initial and Goal State, Successor Function, Objective Function, Goal Test, Goal Path, Example Problems (Missionaries & Cannibals, Wolf Duck and Farmer, 8-Puzzle, 8-Queen)	CLO1
3	Uninformed/Blind Search: Breadth First Search, Uniform Cost Search, Time Complexity	CLO3

	Depth First Search, Depth Limited Search, Iterative Deepening Search Implementation Details on Example Problems	
4	Problem solving through informed searches: Heuristics, Heuristic Functions and Properties, Monotonicity and Admissibility of Heuristics, Optimality vs Efficiency, Best First Search, Greedy Search	CLO3
5	Problem solving through informed searches: Informed Searches: A* Search, Implementation Details on Example Problems	CLO3
6	Classical Search: Meta-Heuristics and Local Search, Hill Climbing, Local minima and Maxima	CLO3
7	Adversarial Search Game Trees, Zero-Sum Games, Minimax Payoff function, Checkers, Tic-Tac-Toe game design	CLO3
8	Adversarial Search Alpha beta pruning, Minimax Algorithm Genetic Algorithms, Representation, Fitness, Selection Review	CLO3
9	Midterm Exams	
10	Local Search Algorithms and Optimization Problems Mutation and Cross over, Solution of 8-queens, TSP problem through Genetic Algorithm	CLO3
11	Knowledge Representation (KR): Logic based, procedural, structural representations First-order logic: Propositional Calculus, Syntax, Connectives, Sentences, Ambiguity in Grammar, Semantics	CLO2
12	Knowledge Representation (KR): Models, Truth Tables, Inference Rules, Practice Session for application of Inference Rules, Wumpus World game design	CLO2
13	Predicate Logic: Problems with propositional logic, Predicates, Universal Quantifiers, Existential Quantifiers, Fuzzy Logic	CLO2, CLO5
14	Introduction to supervised and unsupervised learning. One algorithm for supervised and one algorithm for unsupervised learning. Clustering with K-means, Working example of Naïve Bayes for classification example	CLO4
15	Discusses the basic principles behind robotic systems, Navigation and path planning, Reinforcement learning	CLO4
16	Recent trends in AI (optional) advanced systems overview etc.	CLO4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC202L Artificial Intelligence Lab

Course Description

This Lab course will provide students an opportunity to practically implement the concepts of search techniques and machine learning algorithms to learn how they can be used to solve complex engineering problems. This course will provide an opportunity for students to learn how to model engineering problems and find their solutions using Artificial Intelligence.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Implement uninformed and informed search techniques using appropriate data structures.	PLO-03	Cognitive	3: Apply
CLO2	Analyze logic-based reasoning and problem-solving behavior of agents.	PLO-03	Cognitive	4: Analyze
CLO3	Design and develop an integrated AI-based solution using appropriate tools, frameworks.	PLO-04	Cognitive	6: Create
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Python, Variables, inputs, and output in Python, lists and Arrays	CLO1
2	Functions and Loops in Python Simple searching (Linear search using an array of integers)	CLO1
3	Practice Question for Python covering selection and repetition structures More practice on pandas and Excel file manipulation	CLO1
4	Breadth First Search, Queue, and Priority Queue	CLO2
5	Depth First Search, Stack, and Binary Search implementation	CLO2
6	Iterative Deepening Search, Depth-Limited Search	CLO2
7	Best First Search, A* Search	CLO2

8	Revision Lab	CLO1, CLO2
9	Midterm Exams	
10	Genetic Algorithm	CLO4
11	KNN and K-Means Clustering	CLO4
12	Introduction to Prolog. Domains, predicates and clauses	CLO3
13	Predicate logic using Prolog, FOL	CLO3
14	Alpha beta pruning, minimax Algorithm	CLO3
15	Naïve Bayes Classification	CLO4
16	Group Project	CLO4, CLO5

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC206 Theory of Automata

Course Description

This course provides a foundational understanding of Formal Languages and Automata Theory, which are essential in the study of computation and language processing. Students will explore the formal definition and classification of languages, including regular languages, context-free languages, and their corresponding grammars and expressions. The course covers key models of computation such as deterministic and non-deterministic finite automata, transition graphs, and pushdown automata. Additionally, students will study the design and behavior of Moore and Mealy machines, and gain insights into the capabilities of Turing machines.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain key concepts in formal languages and automata theory.	PLO-01	Cognitive	2. Understand
CLO2	Apply transformations between equivalent computational models such as automata, regular expressions, and grammars.	PLO-02	Cognitive	3. Apply
CLO3	Prove properties of languages, grammars and automata.	PLO-03	Cognitive	5. Evaluate
CLO4	Design automata, regular expressions, and context free grammars.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Course, Evolution of languages, Difference between Formal and Natural languages, Alphabets, Strings, Words, Valid and invalid alphabet, Length of a String, reverse of a String, Introduction to defining languages: Recursive definition of a language, Regular expression. Transition Graph: Definition of Generalized Transition Graph.	CLO 1
2	Regular Languages: Formal definition of defining regular expressions, Languages associated with regular expressions, Relationship between regular expressions, regular languages, finite languages are regular, Introduction to Finite Automata: States, Transition, Acceptance or Rejection of a string, Representation of an FA by Transition Table.	CLO 1

3	Pictorial representation of Finite Automata: Designing Finite Automata for regular languages, Construct FA, accept those string having a double letter in them, Construct FA, accept all words with different first and last letter, Construct FA, accept language of even letters (EVEN-EVEN), Reducing number of states in FA: Deterministic and Non-Deterministic Finite Automata.	CLO 4
4	Convert TG's into Regular Expressions, Converting an NFA to DFA, Kleene's Theorem: Kleene's Theorem (I), Proof I: Define Finite Automaton for every Transition Graph	CLO 2, 3
5	Kleene's Theorem: Kleene's Theorem (II), Proof II: Define Regular Expression for every transition graph, Kleene's Theorem (III), Proof 2: Converting every regular expression into Finite Automata, Kleene's Theorem: Nondeterminism by Kleene's Theorem (FA = NFA)	CLO 3
6	Moore and Mealy Machines: Example of Moore and Mealy Machine, Theorem of Moore and Mealy Machine	CLO 4
7	Non-regular Languages: Pumping Lemma for regular languages, Pumping Lemma length. Regular Languages: Closure properties of Regular Languages, The Myhill- Nerode Theorem.	CLO 3
8	Decidability, decide whether or not a given FA accepts any word, decide whether two FA are equivalent, decide whether two regular expressions are equivalent, Demonstration of JFLAP: Software for the simulation of Mathematical Models (Abstract Machines). Decidable Problems of Regular Languages: membership, finiteness, emptiness, equivalence	CLO 3
9	Midterm Exams	
10	Introduction to Grammars: Defining different Classes of Grammars, Regular Grammar, Context Free Grammar, CFG for different languages and understanding languages defined by CFG, Derivation: Left Most and Right Most Derivation, Parse Trees, Ambiguous grammars, Total language tree.	CLO 4
11	Simplification of Context-Free Grammar: Killing Productions, Killing Null Productions, Removing Unit Productions, Removing Useless Productions, Conversion to Chomsky Normal Form, Conversion to Greinbach Normal Form.	CLO 2
12	PDA and Context Free Languages, Deterministic and Non-deterministic PDA, Designing PDA for different language.	CLO 4
13	CFG = PDA: Building CFG for every PDA, Building PDA for every CFG. Building CFG for DFA.	CLO 2
14	Context-Free Language: CFL is closed under the operation of Union, CFL is closed under the operation of Concatenation, CFL is closed under the operation of Kleene Closure, CFL is NOT closed under the operation of Intersection, CFL is NOT closed under the operation of Complement, The intersection of regular and context-free language is also context free,	CLO 3

	Theorem proof practice for pushdown automata and context free language	
15	Turing Machine, Turing Machine Construction, Turing Machine examples	CLO 4
16	Turing Machine • The subprogram INSERT • The sub–Program DELETE Revision	CLO 4

University of Engineering and Technology Lahore

Course Outline Report

Subject: CSC208 Design and Analysis of Algorithms

Course Description

This course provides a rigorous foundation in the design, analysis, and optimization of algorithms, emphasizing both theoretical principles and practical applications. Students will learn to evaluate algorithmic efficiency using asymptotic analysis, apply key paradigms (divide-and-conquer, dynamic programming, greedy methods), and solve real-world computational problems.

CLO No.	Learning Outcome	PLO	Domain	Domain Level
CLO1	Explain fundamental algorithmic concepts such as recursion, divide-and-conquer, greedy methods, and dynamic programming.	PLO-01	Cognitive	2: Understand
CLO2	Apply algorithmic strategies to solve computational problems in various domains.	PLO-02	Cognitive	3: Apply
CLO3	Analyze the time and space complexity of recursive and non-recursive algorithms using asymptotic notations.	PLO-03	Cognitive	4: Analyze
CLO4	Compare and contrast different algorithms for the same problem based on performance and applicability.	PLO-04	Cognitive	5: Evaluate
CLO5	Design efficient solutions for problems using appropriate algorithm design paradigms and data structures.	PLO-04	Cognitive	6: Create

Week	Topics	Mapped CLOs
1	Introduction to Algorithms, Algorithmic efficiency, Pseudocode, Complexity classes, Order of growth	CLO1
2	Asymptotic Analysis (Big-O, Ω, Θ), Growth of Functions	CLO3
3	Recursive & Non-Recursive Algorithms and their analysis	CLO3
4	Decrease and Conquer (e.g. Insertion sort, string matching) and Iterative Codes (e.g. Linear search)	CLO1, CLO2, CLO3
5	Divide & Conquer (Binary Search, Merge Sort, Quick Sort, Matrix Multiplication)	CLO1, CLO2, CLO3

6	Recurrence Relations, Master Theorem, substitution method, recurrence tree method	CLO3
7	Brute force and Exhaustive Technique (Sorting, TSP, Assignment Problem)	CLO1, CLO2, CLO4
8	Greedy Algorithms (Activity Selection, Huffman Coding, Knapsack)	CLO1, CLO2, CLO4
9-10	Dynamic Programming (Rod Cutting, LCS, 0/1 Knapsack, Matrix Chain Multiplication, Optimal BST)	CLO1, CLO2, CLO4
11-12	Backtracking & Branch and Bound (N-Queens, TSP, Subset Sum)	CLO1, CLO2, CLO4
13	Graphs I: Representations, BFS, DFS, Topological Sort	CLO4, CLO5
14	Graphs II: Dijkstra, Bellman-Ford, Floyd-Warshall	CLO4, CLO5
15	Minimum Spanning Trees (Kruskal, Prims)	CLO4, CLO5
16	Project (Presentation/Viva)	CLO5

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC207 Advanced Database Management Systems

Course Description

This course explores advanced topics in database systems, including transaction management, and concurrency control. Students will gain knowledge about indexing techniques, file organization, and query optimization to enhance performance and efficiency. The course also covers database recovery, security, and integrity mechanisms. In the latter part, students will analyze distributed databases, NoSQL technologies, and emerging trends such as MongoDB, Hadoop, and MapReduce to address modern data scalability and processing challenges.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain advanced data models, transaction management, and concurrency control techniques used in modern database systems.	PLO-01	Cognitive	2. Understand
CLO2	Apply indexing, file organization, and query optimization techniques to improve data access and system performance.	PLO-02	Cognitive	3. Apply
CLO3	Analyze distributed databases and emerging technologies to address scalability, consistency, and semi-structured data challenges.	PLO-03	Cognitive	4. Analyze

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Overview of course objectives, applications of advanced DB concepts, and differences from basic DBMS.	1
2	Evolution from hierarchical, network, relational, to object-oriented and NoSQL databases.	1
3	NoSQL: Document stores, JSON queries, schema flexibility, operations, NoSQL design principles.	1
4	Fundamentals of transactions, atomicity, consistency, isolation, durability.	1
5	Concurrency control, locking, timestamp ordering, Two-Phase Locking (2PL), and Multiversion Concurrency Control (MVCC).	1

6	Advanced index structures (B+ Trees, Tries, Skip Lists) for fast in-memory data retrieval.	2
7	In-memory hash tables, Bloom filters, and performance trade-offs in indexing.	2
8	Query processing, heuristics, cost-based optimization, join ordering, and rewriting strategies.	2
9	Midterm Exams	
10	Logging, Write-Ahead Logging (WAL), checkpoints, undo/redo recovery strategies.	3
11	CAP theorem, trade-offs in distributed systems, consistency types (eventual, strong, causal).	3
12	Introduction to data mining and data warehousing	3
13	Indexing for IR, precision, recall, ranking algorithms, and full-text search techniques.	3
14	Distributed databases, data fragmentation, replication, distributed query processing, and coordination.	3
15	Big Data Technologies for Distributed Databases, HDFS, MapReduce programming model	3
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC207L Advanced Database Management Systems Lab

Course Description

This lab course provides practical experience with advanced database concepts including NoSQL systems, indexing, transaction management, and distributed databases. Students gain hands-on skills in designing and querying document-based databases like MongoDB, implementing indexing structures such as B+ Trees and hash tables, and simulating transaction control and concurrency scenarios. The course also introduces query optimization techniques, data warehousing, and basic data mining tasks using tools like Weka or Orange. Through lab exercises and a final project, students explore scalability, consistency, and performance in modern data-driven environments.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Implement advanced data models, transaction management, and concurrency control techniques used in modern database systems.	PLO-01	Cognitive	3. Apply
CLO2	Apply indexing, file organization, and query optimization techniques to improve data access and system performance.	PLO-02	Cognitive	3. Apply
CLO3	Analyze distributed databases, NoSQL systems, and emerging technologies to address challenges of scalability, consistency, and semi-structured data processing.	PLO-03	Cognitive	4. Analyze
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to advanced DBMS lab setup; install MongoDB or another NoSQL tool	1
2	Practice JSON document modeling and CRUD operations in MongoDB	1
3	Write MongoDB aggregation queries; explore flexible schema capabilities	1

4	Write scripts to simulate ACID transactions using PL/SQL or MongoDB transactions	1
5	Simulate concurrency control using lock and timestamp ordering with sample transaction logs	1
6	Implement B+ Tree indexing on sample datasets (in-memory simulation or tool-based)	2
7	Implement hash-based indexing and simulate Bloom filters in Python/SQL	2
8	Cost-based SQL query optimization: explain plans, analyze joins and indexes	2
9	Midterm Exams	
10	Implement WAL simulation using logs in SQL Server or any journaling logic	2
11	CAP theorem simulation: consistency/availability trade-off demo with MongoDB replication sets	3
12	Design a warehouse schema and perform basic data mining operations such as classification and association rule mining.	3
13	Build a small IR index; compute precision and recall for document retrieval scenarios	3
14	Use basic sharding or replication with MongoDB or simulate fragmentation logic	3
15	Run a simple MapReduce job using Hadoop streaming or PySpark	3
16	Final Project Submission + Demos	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC300 Operating Systems

Course Description

The Operating Systems course offers a comprehensive study of the fundamental concepts and design principles behind modern operating systems. Topics include process management, scheduling, memory management, file systems, concurrency, synchronization, and security. Students learn how operating systems manage hardware resources and provide services for application software. The course also covers virtualization, system calls, and case studies of popular OS like Windows, Linux, and UNIX. Through theoretical instruction and hands-on assignments, students gain a solid understanding of OS architecture and functionality. This course prepares students for advanced system-level programming and enhances their problem-solving and analytical skills in computing environments.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Describe the characteristics of different structures of Operating Systems and identify their core functions.	PLO-01	Cognitive	2: Understand
CLO2	Analyze the algorithms of the core functions of Operating Systems and explain their major performance issues.	PLO-03	Cognitive	4: Analyze
CLO3	Develop operating system components by applying appropriate algorithms and justify the design choices based on performance trade-offs.	PLO-04	Cognitive	6: Create

Tentative Weekly Lecture Plan

Week	Topic	CLO Mapping
1	Overview of OS - Computer system organization - Kernel & OS architecture - Single vs. multiprocessor systems	CLO1

Week	Topic	CLO Mapping
2	OS Structures - System calls, OS design - Layered approach, microkernels - UNIX & MS-DOS structures	CLO1
3	Processes - Definitions, process states - Linux process tree, operations - Forking, process lifecycle	CLO1
4	Process Scheduling & IPC - Long/short-term scheduling - Shared memory, message passing - POSIX shared memory	CLO2
5	Threads & Multicore - Thread models, libraries - Linux threads, challenges - Multicore programming	CLO2
6	Process Synchronization - Critical section problem - Peterson’s solution, mutexes - Semaphores, monitors	CLO2
7	Classic Sync Problems - Bounded buffer - Readers-writers - Dining philosophers	CLO2
8	CPU Scheduling - Scheduling criteria - Algorithms (RR, Priority, MLQ) - Multiprocessor scheduling	CLO2
9	Midterm Exam	

Week	Topic	CLO Mapping
10	Deadlocks - Characterization - Prevention, avoidance - Detection & recovery	CLO2,3
11	Memory Management - Swapping, fragmentation - Paging, segmentation - Protection mechanisms	CLO2,3
12	Virtual Memory - Demand paging - Page replacement (FIFO, LRU) - Thrashing, kernel memory	CLO2,3
13	Storage & File Systems - Disk scheduling (SCAN, C-SCAN) - File system implementation - Directory structures	CLO2,3
14	Security - Threats (malware, DoS) - Cryptography, firewalls - Authentication mechanisms	CLO1
15	Project Implementation - Simulate a CPU scheduler OR memory manager (Using Round Robin, LRU, etc.)	CLO1,2,3
16	Revision	CLO1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC300L Operating Systems Lab

Course Description

This lab course is designed to give understanding of underlying concepts and principles for the implementation of contemporary operating systems. Starting from exploring various system commands, services, and system programs. the lab work interfaces include shell programs. All exercises/practical work will be done on UNIX/Linux OS system. Also, Students will examine important UNIX and Linux data structures. Programming language environment: C on UNIX/Linux.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Implement core Operating System functions in a programming environment to demonstrate understanding of theoretical concepts.	PLO-01	Cognitive	3: Apply
CLO2	*Compare* the performance of different Operating System algorithms through simulation	PLO-03	Cognitive	5: Evaluate
CLO3	Program and troubleshoot race conditions, deadlocks, and memory management issues in multi-threaded/process-based programs and propose solutions.	PLO-04	Cognitive	6: Create
CLO4	Comply with ethics and professional practices in computing	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Lab Topic	Mapped CLO
1	Linux OS Basics, Installing Linux in virtual environment - Shell commands, file systems, process monitoring (ps, top).	CLO1
2	Intro to the C Language	CLO1

Week	Lab Topic	Mapped CLO
3	Process Creation - Write a C program using fork(), exec(), wait().	CLO1
4	Simulation of IPC (Shred memory and Message passing)	CLO-1
5	Threads vs. Processes - Create multi-threaded programs (pthreads) and compare performance.	CLO2
6	Process Synchronization - Solve the producer-consumer problem using semaphores.	CLO3
7	Classic Sync Problems - Implement deadlock-free solutions for Dining Philosophers.	CLO3
8	Lab Evaluation	
9	Midterm Exam	
10	CPU Scheduling Simulator - Implement FCFS/SJF, Round Robin, scheduling and compare turnaround times.	CLO3
11	Memory Allocation - Simulate dynamic memory allocation with fragmentation analysis.	CLO2,3
12	Page Replacement Algorithms - Compare FIFO vs. LRU using a page fault simulator.	CLO2,3
13	File System Operations - Build a custom file handler (read/write/seek) in C.	CLO1

Week	Lab Topic	Mapped CLO
14	Deadlock Detection - Program Banker's Algorithm to detect safe/unsafe states.	CLO2,3
15	Disk Scheduling Simulator - Compare SCAN vs. C-SCAN algorithms.	CLO2,3
16	Project Evaluation	CLO1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC301 Introduction to Human Computer Interaction

Course Description

The course focuses on the principles and methods of human- computer interaction (HCI) and Interaction Design (ID) to deal with the demands of twenty-first-century computing and the demands for improved user experience (UX). UX and ID are concerned with the design of websites, desktop applications, smartphone apps, ubiquitous computing systems, mobile systems, wearable systems and systems to support cooperation between people. UX and ID are concerned with the development of novel apps, visualizations, auditory displays and responsive environments. HCI is about how to design for these experiences in a human-centered way that takes account of human abilities and preferences and ensures that systems are accessible, usable and acceptable.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the context, goals, and foundational concepts of Human Computer Interaction	PLO-01	Cognitive	2. Understand
CLO2	Apply the principles of good design that address user diversity	PLO-04	Cognitive	3. Apply
CLO3	Document user and system requirements for designing effective and usable interfaces.	PLO-02	Cognitive	3. Apply
CLO4	Analyze the usability and effectiveness of user interfaces using established frameworks and heuristics.	PLO-03	Cognitive	4. Analyze

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Human factors in interface design.	1
2	Understanding of perception, cognition, limitations, memory.	1
3	Rules and Guidelines for Designing User-Computer Interfaces.	2
4	Study of design principles such as FURPS and FURPS+	2
5	Desirable properties of an effective user interface.	2

6	Study of number of clicks, eye tracking, feedback, scenarios, screen recording, etc.	2
7	Gathering user requirements, creating scenarios, personae.	3
8	Establishing the requirement document.	3
9	Mid Term	
10	Types of interfaces and their applicability, navigation layouts, navigation styles	3
11	Enhancing the interactivity and element choice with respect to the target environment.	3
12	Executing the interface evaluation. Comparison of questionnaires, lab testing, real environment-based evaluation.	4
13	Creating the interface using high fidelity and low fidelity interfaces. Horizontal and vertical prototyping. E.g. wizard of oz prototyping, pen and paper prototyping and storyboarding	4
14	Heuristic Evaluation and Nielsen's 10 Usability Heuristics	4
15	Usability Testing and User Observation Techniques	4
16	Review	1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC302 Computer Architecture

Course Description

This course extends the concepts of computer organization and uniprocessor architecture to more advanced topics. These topics include structures and functions of modern digital computer systems, advanced pipelined Reduced Instruction Set Computer (RISC) machines, instruction level parallelism (ILP), dynamic scheduling, thread level parallelism (TLP), multi-processors, memory hierarchy design, storage systems and I/O devices. The course provides the students with current trends and future insight to modern computer architecture design.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Describe the structure and functionality of general-purpose computer systems.	PLO-01	Cognitive	2: Understand
CLO2	Analyze microarchitectural solutions in RISC and CISC systems.	PLO-03	Cognitive	4: Analyze
CLO3	Explain the role and functionality of peripheral devices in a computer system.	PLO-02	Cognitive	2: Understand

Tentative Weekly Lecture Plan

Week	Topics	Mapped CLOs
1	Introduction to Computer Architecture, General-Purpose Machine Concepts	CLO-1
2	The User's View, Programmer's View, Architect's View, Historical Trends	CLO-1
3	Computer Classifications, Instruction Set Overview	CLO-1
4	Introduction to SRC Architecture, Informal and Formal Descriptions	CLO-1
5	Addressing Modes and RTN, Instruction Formats	CLO-1
6	Register Transfers, Logic Circuits, RTL to Hardware	CLO-2
7	Peripheral Devices: Input (keyboard, mouse), Output (monitors, printers), Memory Mapped I/ O	CLO-3

8	Interrupts and DMA, Bus Systems, Device Controllers	CLO-3
9	Midterm Exam	
10	Cache Memory, DRAM Technology, and Memory Hierarchies	CLO-3
11	RISC vs CISC Architectures	CLO-1,2
12	1 Bus Microarchitecture for SRC, Datapath Design, Pipelining	CLO-1,2
13	Logic Design and Control Unit for 1 Bus SRC	CLO-1,2
14	2-Bus Architectures, Machine Reset and Exceptions	CLO-1,2
15	Superscalar Execution, Instruction Level Parallelism	CLO-1,2
16	Intro to Multicore architectures, Revision	CLO-1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC303 Compiler Construction

Course Description

This course analyses issues associated with the implementation of compilers of high-level programming languages. The topics covered include fundamental concepts, functions, and structures of compilers, implementation of basic compilation techniques, the interaction of theory and practice in implementation, and using automated tools in building compilers. The course features a project on design and implementation of a mini-compiler that will be written in C++/c#/Java and generates 3-address/assembly code for a high-level programming language. The objective of the course is to teach lexical analysis, parsing and semantic analyzing techniques for solving problems encountered universally in designing a language compiler, regardless of source or target machine. These techniques are also useful in everyday software development.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO 1	Demonstrate key concepts and phases of a compiler including lexical analysis, syntax analysis, semantic analysis and intermediate code generation.	PLO-01	Cognitive	2: Understand
CLO 2	Implement core phases of compiler and its supporting components such as error handler and symbol table manager.	PLO-02	Cognitive	3: Apply
CLO 3	Compare various implementation techniques of phases of compiler.	PLO-03	Cognitive	4: Analyze
CLO 4	Design a compiler for a subset of a programming language by integrating its phases.	PLO-04	Cognitive	6: Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Compilers, History, Prerequisites & Classifications, Steps in Human Translation, Examples of Compilation Techniques in Everyday Software.	CLO 1
2	Analysis Synthesis Model of Compilation, 6 Phases of a Compiler, Context of Compiler: Preprocessor, Compiler, Assembler, Linker, Loader/Link Editor, Compiler	CLO 1

3	A Simple One Pass Compiler: A quick review of grammars and languages, Chomsky Hierarchy of Formal Languages, Syntax Definition, Syntax & Parse Tree, Ambiguity, Associativity & Precedence of operators.	CLO 3
4	A Simple One Pass Compiler: Parsing, Syntax-directed Translation, Infix to Postfix, Expression Evaluation, A Translator for Simple Expressions. Lexical Analysis. Incorporating symbol table. Abstract stack machines.	CLO 3
5	Lexical Analysis: The role of the lexical analyzer, Input Buffering, Double Buffering Implementation Using Multithreading, Specification of Tokens by Regular Expressions & Regular Grammar, Recognition of Tokens by Finite Automata	CLO 2
6	Lexical Analysis: Implementation of a lexical analyzer by Maintaining State- based Finite Automata, By Stateless Finite Automata, By State Table Techniques, By State Table Compression Technique.	CLO 2 CLO 4
7	Construction Tools: Lex/flex. Implementation of Lexical Analyzer using Flex tool.	CLO 2 CLO 4
8	Parsing: Context-free grammar, Push Down Automata, Parse Trees and Derivations, Writing a grammar, Ambiguity, Ambiguity Elimination Techniques, Left factoring, Left Recursion, Automatic Removal of Left Factoring & Left Recursion, Top-down parsing: Recursive Descent Parsing, Recursive Predictive Parsing & Its Implementation.	CLO 3
9	Mid term	
10	Error Handling: The role of the parser, Levels of Errors and Syntax Error Handling, Error recovery in parsing: Panic Mode, Phrase Level, Error Production, Global Correction, Error Reporting.	CLO 2
11	Parsing: Non-Recursive predictive parsing, First and Follow Sets, Automatic First & Follow Set Computation, LL(k) Grammars, Parsing table, Automatic Construction of Parsing Table, Non-Recursive Predictive parsing implementation techniques, Error Recovery in Predictive Parsing Technique.	CLO 3
12	Parsing: Shift Reduce Parsing and Conflicts Resolution, Operator-precedence parsing, Automatic Parser generators. Construction Tools: YACC/Bison.	CLO 3 CLO 4
13	Symbol Table Management: Major Data Structures used in Symbol Table Manager and Their Time/Space Complexity Comparison.	CLO 2 CLO 4
14	Symbol Table Management: Symbol Table Manager Implementation issues, Representation of scope information in Symbol Table.	CLO 2 CLO 4
15	Advanced Topics: Semantic Analysis, Intermediate Code Generation, Code Optimization, Architecture of Modern Compilers, Semantic Compilers.	CLO 3
16	Revision	

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC303L Compiler Construction Lab

Course Description

The objective of this lab is to provide a foundational base of the different phases involved in compiler design and construction. It is achieved by making the students implement simple programs related to different phases associated with the design of compilers. The programming is mostly done using C++/C#/Java and automated compiler construction tools such as JFlex/Flex and YACC/Bison are used in implementing the front end of compiler. At the end of the lab course the student is equipped with a basic idea and practical implementation of a simple compiler construction for a given programming language.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO 1	Demonstrate the working of compiler components such as symbol table, error handler, and expression evaluator used in the analysis phase.	PLO-01	Cognitive	2. Understand
CLO 2	Implement lexical analyzer for a subset of a programming language (identifiers, literals, operators, etc).	PLO-02	Cognitive	3. Apply
CLO 3	Compare recursive and non-recursive parsing techniques for syntax analyzer	PLO-03	Cognitive	4. Analyze
CLO 4	Develop a compiler by integrating its different phases using automated tools.	PLO-04	Cognitive	6. Create
CLO 5	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Expression Evaluator	CLO 1
2	Expression Evaluator	CLO 1
3	File handling and double buffering using multithreading	CLO 1
4	File handling and double buffering using multithreading	CLO 1

5	Implement the lexical analyzer for subset of programming language (identifier, literals, operators, etc.) using state diagram.	CLO 2
6	Implement the lexical analyzer for subset of programming language (identifier, literals, operators, etc.) using state diagram.	CLO 2
7	Recursive decent parser implementation	CLO 3
8	Recursive decent parser implementation	CLO 3
9	Mid term	
10	Develop the lexical and syntax analysis phase of compiler using automated tools (Lex/Flex, YACC/Bison, etc.)	CLO 4
11	Non-recursive parser implementation.	CLO 3
12	Non-recursive parser implementation.	CLO 3
13	Symbol table manager and error handling implementation.	CLO 1
14	Symbol table manager and error handling implementation.	CLO 1
15	Semantic rules implementation using automated compiler generation tool.	CLO 4
16	Project Evaluation	CLO 4 CLO 5

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC304 Parallel and Distributed Computing

Course Description

This course covers the core concepts of parallel and distributed computing. It emphasizes on system architectures, communication, synchronization, and fault tolerance. The course also focuses on performance, scalability, and how to apply these techniques to solve computing problems effectively.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the fundamental principles, goals, and classifications of parallel and distributed computing systems.	PLO-01	Cognitive	2. Understand
CLO2	Analyze the architectural and performance aspects of parallel and distributed systems, including resource utilization, scalability, memory models, and execution optimization.	PLO-02	Cognitive	4. Analyze
CLO3	Apply techniques for communication, synchronization, and fault tolerance in parallel and distributed systems.	PLO-02	Cognitive	3. Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	**Introduction to Parallel and Distributed Computing** o Overview o Key differences o Guidelines for selecting the appropriate computing model	CLO1
2	**Design Goals of Distributed Systems** o Resources Accessibility o Distribution Transparency o Openness o Dependability o Scalability o Security	CLO1
3	**Design Goals of Parallel Systems** o High Performance	CLO1

	○ Efficient Resource Utilization ○ Scalability ○ Load Balancing ○ Minimal Communication Overhead	
4	**Classification of Distributed Systems** • **High-performance distributed computing** ○ Cluster computing ○ Grid computing • **Distributed information systems** ○ Distributed transaction processing ○ Enterprise application integration • **Pervasive systems** ○ Ubiquitous computing systems ○ Mobile systems ○ Sensor networks	CLO1
5	**Organization of distributed systems** • logical organization (software architecture) • physical organization • Client Server • P2P • Hybrid (BitTorrent)	CLO1 CLO3
6	Von Neumann Architecture Processes, multitasking, and threads **Techniques for making CPU faster** 1. Cache 2. Virtual memory	CLO2
7	**Techniques for making CPU faster** 3. Instruction-level parallelism ○ Pipelining ○ Multiple issue ○ Hardware Multi-Threading	CLO2
8	**Amdahl's Law** • Why speedup plateaus • Limits of single-core and multithreaded CPUs	CLO2
9	Midterm Exams	
10	**Classifications of parallel computers** 1. SIMD systems a. Vector processors b. Graphics processing units 2. MIMD systems (multicore processors systems) ○ distributed-memory ○ shared-memory systems	CLO2
11	**GPU architecture** Difference in CPU/GPU computation Heterogeneous computing	CLO2
12	**Types of Communication** 1. Synchronous Vs. Asynchronous	CLO3

	2. Transient Vs. Persistent 3. Discrete Vs. Stream	
13	Remote Procedure Call Message-Oriented Communication	CLO3
14	Unicast Communication Multicast Communication • Gossiping technique • Anti-Entropy technique Broadcasting Communication	CLO3
15	**Synchronization** • Physical Clocks • Logical Clocks • Mutual Exclusion • Election Algorithms for coordinator selection • GPS	CLO3
16	**Fault Tolerance** **Process Resilience** • Flooding based consensus • PAXOS	CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC304L Parallel and Distributed Computing Lab

Course Description

This lab-based course provides hands-on experience in parallel and distributed computing using industry-standard tools and frameworks such as MPI, OpenMP, CUDA, and Hadoop. Students will develop programs that leverage shared and distributed memory architectures and analyze their performance. The course emphasizes synchronization, performance evaluation, and the practical application of parallel programming constructs.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Demonstrate understanding of basic principles and programming models used in parallel and distributed computing.	PLO-01	Cognitive	2. Understand
CLO2	Apply parallel and distributed programming constructs using standard tools and environments.	PLO-05	Cognitive	3. Apply
CLO3	Analyze synchronization and performance aspects in parallel and distributed applications.	PLO-03	Cognitive	4. Analyze
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	**Introduction to Hadoop** • Understand Hadoop's role in Big Data processing • Identify limitations of traditional data processing systems • Explore the need for distributed computing • Discuss use cases (e.g., large-scale analytics, log processing, recommendation systems) • Install and configure Hadoop on local/cluster setup	CLO1
2	**Hadoop Architecture and Ecosystem** • Understand the core components of the Hadoop architecture • Explore HDFS (Hadoop Distributed File System) and MapReduce programming model	CLO1

	• Overview of Hadoop ecosystem tools and their functions	
3	**HDFS and MapReduce Programming** • Create and manage directories in HDFS • Implement basic data processing tasks using MapReduce	CLO1 CLO2
4	**Introduction to Parallel Programming & Environment Setup** • Set up development environment for parallel programming • Write, compile, and execute basic C programs	CLO1
5	**Distributed Memory Programming with MPI** • Understand message passing and point-to-point communication • Measure performance using MPI-based programs	CLO1 CLO2
6	**Distributed Memory Programming with MPI** • Implement broadcasting and collective communication • Analyze and handle deadlocks in MPI applications	CLO2 CLO3
7	**Shared Memory Programming with Threads** • Create, start, and terminate threads using POSIX threads (Pthreads) • Understand thread life cycle and management	CLO1 CLO2
8	**Thread Synchronization Techniques** • Implement synchronization using busy waiting, mutexes, semaphores • Use barriers and read-write locks for shared data access	CLO2 CLO3
9	Midterm Exams	
10	**Introduction to OpenMP** • Use OpenMP to parallelize loops in C programs • Measure speedup and analyze thread scalability	CLO1 CLO2
11	**OpenMP Synchronization and Reduction** • Use critical sections, barriers, and reduction clauses • Detect and resolve race conditions • Perform parallel reduction operations	CLO2 CLO3
12	**Performance Analysis** • Compare execution time and efficiency of serial and OpenMP programs • Interpret speedup and efficiency metrics	CLO3
13	**Introduction to CUDA Programming** • Understand the CUDA architecture and kernel execution model • Write and run basic CUDA kernel programs	CLO1 CLO2
14	**CUDA Vector Addition** • Implement vector addition using CUDA • Measure and evaluate performance gain over CPU-based execution	CLO2 CLO3
15	**CUDA Shared Memory and Optimization** • Use shared memory to optimize CUDA kernels • Observe performance improvement through memory hierarchy utilization	CLO2 CLO3
16	**Semester Project**	CLO2 CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC403 Professional Practices in Software Development

Course Description

A computing graduate as a professional has some responsibilities concerning society. This course is part-course designed to help prepare for the examination to become a Certified Software Development Professional (CSDP). This course develops students' understanding of historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources of information and opinions about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies. In addition, the course will address one or more of the fifteen Knowledge Areas that comprise the Software Engineering Body of Knowledge - or SWEBOK. Professional Practice is concerned with the knowledge, skills, and attitudes that software engineers must possess to practice software engineering in a professional, responsible, and ethical manner. The study of professional practices includes the areas of technical communication, group dynamics and psychology, social and professional responsibilities.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain basic concepts of professional practices in software development and associated social, ethical, economic, and professional issues in the computing profession.	PLO-01	Cognitive	2: Understand
CLO2	Apply the knowledge that computing professionals must possess to practice as professionals.	PLO-02	Cognitive	3: Apply
CLO3	Comply with ethics and professional practices in computing	PLO-09	Affective	3: Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Course-What is Profession & Professionalism-Traits of a Professional	CLO1
2	Structure of computing profession-Software Engineering vs Software Development, Some Professional Practices for a successful software project development-Ethics, Professional Ethics, Ethical issues of Computer Science	CLO1

3	IEEE/ACM Professional codes of conduct-Ten Commandments of computer ethics	CLO1
4	Applying codes of conduct (Case Studies).	CLO1
5	The Structure of an Organization-Companies, types of companies-Functional units of an organization-Different Management Roles in an organization	CLO1
6	Anatomy of a software house Company structure, Types of software companies, Management of Staff and Projects, Producing Budget, Long term planning.	CLO1
7	Software Project Management, Management Spectrum, Software Team Structure, Coordination and communication, complete software development planning from start to delivery of final product.	CLO1
8	Intellectual Property Rights: Copyright, Designs, Patents, Trademarks	CLO2
9	Midterm Exams	
10	Computer Contracts: Introduction, types of contracts, structure of a contract	CLO2
11	Software safety: liability and practice: Introduction, Regulatory Issues, Legal liabilities, Factors affecting system safety.	CLO2
12	Working in Team: decision making, team structures, dispersed and virtual teams, leadership.	CLO3
13	Computer Misuse and Criminal Law	CLO2
14	Class Presentations	CLO3
15	Class Presentations	CLO3
16	Revision	CLO1, CLO2, CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC310 Graph Theory

Course Description

This course introduces students to the basics of Graphs in Computer Science. This subject introduces the fundamental concepts of Graph Theory and provides knowledge for application of Graph Theory in computability theory, software engineering, and computer systems.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain fundamental concepts of Graph Theory, including types of graphs, graph representations, and basic terminologies.	PLO-01	Cognitive	2. Understand
CLO2	Apply graph-theoretic principles to solve computational problems related to paths and connectivity in computer science domains.	PLO-02	Cognitive	3. Apply
CLO3	Design and construct graph-based models and algorithms for solving real-world problems in areas such as scheduling, resource allocation, and social networks.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Graph Theory, Basic definitions, computer representations and properties of Graph	1
2	Types of Graphs, Fundamental theorems of Graph Theory, Isomorphism of graphs, Paths and circuits	1
3	Trees vs. Graphs, Traversals, Searches in Graphs, BFS, DFS	2
4	Introduction to connectivity, Vertex Cuts and Edges Cuts, Connectivity and Edge Connectivity, Blocks, Cyclical Edge Connectivity of a Graph	2
5	Paths, Cycle and distance in graphs, weighted graphs and digraphs, shortest path algorithms.	2
6	Online Networks as Graphs, applying graph algorithms to real-world graphs	2
7	Graph Mining, Basics of network and graph analysis	3

8	Business graphs, Bipartite and Heterogeneous graphs	3
9	Midterm Exams	
10	Eulerian and Hamiltonian Graphs and Applications	1, 2
11	Flow networks, Max-flow Min-cut Theorem	3
12	Graph coloring, Edge coloring,	3
13	Planar graphs and their properties, four color theorem	3
14	Matchings in graphs	3
15	Dominance & Ramsey theory, Special topics in Graph Theory (Knowledge Graphs, Graph Representation Learning, Graph Database etc.)	1, 3
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC410 Mobile Application Development

Course Description

This project-based course equips students with skills to design, develop, and deploy cross-platform mobile applications (Android/iOS) using modern frameworks. Topics include UI/UX design, backend integration (Firebase, APIs), security, and monetization. Students will build a portfolio-ready app meeting market demands.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Discuss the challenges in designing and building applications for mobile and always-connected computing environments.	PLO-01	Cognitive	2: Understand
CLO2	Implement core concepts of mobile application architecture and frameworks.	PLO-02	Cognitive	3: Apply
CLO3	Examine how material design standards and accessibility features contribute to the development of user-centered mobile interfaces.	PLO-03	Cognitive	4: Analyze
CLO4	Develop scalable mobile applications by integrating backend services and external APIs, following all phases of the software development life cycle.	PLO-04	Cognitive	6: Create

Tentative Weekly Lecture Plan

Week	Topics	CLOs
1	Introduction: Mobile ecosystems, Android/iOS comparison, SDLC, 3-tier design, MVC, Thick/Thin Clients	CLO1
2	Android Fundamentals: Activities, Lifecycle, Intents, Logcat	CLO2
3	UI/UX Principles, Material Design, UI/UX Process: Wireframing → Prototyping	CLO3
4	UI Design: Linear/Relative, XML UI design, Constraint Layout (Material Design, Intents)	CLO3
5	Fragments & Navigation: Bottom Navigation, Drawer, Fragments, Dialogs, Activity Stack	CLO2, CLO3
6	Broadcast Receivers (Implicit/Explicit)	CLO2
7	Hands on Lab: XYZ App (UI/UX Design (Figma Prototyping, Frontend with Integration of core components studied)	CLO1, CLO2, CLO3, CLO4

8	Firebase Integration: Auth, Realtime DB.	CLO2
9	Midterm	
10	REST APIs: Retrofit, JSON parsing, Recycler View	CLO2,CLO3
11	Data Persistence and sharing: Preferences and Shared Preferences, Content Provider	CLO2
12	Services: Background tasks, Threading	CLO2
13	Security: Permissions, Authorization and Authentication	CLO1,CLO2
14	Hands on Lab: XYZ App (UI/UX Design (Figma Prototyping Complete, Complete Frontend and backend Integration of core components, API, Databases etc.)	CLO1, CLO2, CLO3, CLO4
15	Performance Optimization: Profiling, caching, Monetization: Ads, Subscriptions, Introduction to AR/VR, wearable computing	CLO1
16	Capstone Project: Full-stack app (UI + Firebase + APIs).	CLO4

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC414 Enterprise Application Development

Course Description

The basic purpose of an Enterprise Application Development course is to equip students with the knowledge and skills needed to design, develop, deploy, and maintain software applications that cater to the needs of large organizations or enterprises. These applications are typically more complex and have specific requirements due to the scale and intricacies of enterprise operations. After passing this course student will be able to develop enterprise desktop and web application.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the role of enterprise information systems in supporting business operations, processes, and data needs across functional areas.	PLO-01	Cognitive	2. Understand
CLO2	Apply key programming principles, object-oriented concepts, architectural patterns, and best practices to develop structured software applications.	PLO-02	Cognitive	3. Apply
CLO3	Develop scalable desktop and web applications by integrating modern frameworks, web services, and CRUD operations.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Enterprise Information Systems and Enterprise Resource Planning (ERP): definition, historical evolution, modular structure, advantages and disadvantages, and current implementation issues including security and privacy concerns.	CLO 1
2	Overview of business functions, processes, and functional areas; understanding the data needs and data generation within each functional area; introduction to integrated information systems and their role in supporting business operations.	CLO 1
3	Introduction to ASP.Net Core, C# programming concepts including Tuples, Params, Data types, Lists, Loops.	CLO 2

4	Object-Oriented Programming concepts including namespaces, access modifiers (internal, private, public), partial classes, and class properties. Development of a custom math library and deployment as a NuGet package on the Microsoft platform.	CLO 2
5	Implicit and explicit type casting, exception handling, file handling. N-Tier Architecture, action and function delegates.	CLO 2
6	Introduction to database connectivity, ADO.NET, SQL injection attack, parameterized queries. *Using* statement for scoped object creation and automatic disposal of resources implementing *IDisposable interface.*	CLO 2
7	Introduction to Windows Presentation Foundation, Dock Panel, Stack Panel, Grid Layout, Wrap Panel, Events handling, Frontend GUI Design.	CLO 3
8	Introduction to Model View View Model (MVVM) in WPF. Data binding, IvalueConverter, Data context, CRUD using ADO.NET. Deployment of WPF Application.	CLO 2, 3
9	Midterm Exams	
10	Introduction to ASP.net Core MVC, ASP.net Core Razor Dynamic Pages, strongly typed Views, Viewbag/Viewdata/TempData. Server-side validation using data annotations and ModelState.	CLO 2, 3
11	Front End Development, HTML, CSS, JavaScript, Tailwind/Bootstrap	CLO3
12	Introduction to Language integrated queries (LINQ). Entity framework, database design and creation, CRUD operations.	CLO3
13	Introduction to web services (Soap and Restful), CRUD with Web API in ASP.net core.	CLO3
14	jQuery selectors, DOM manipulation, event handling, animations, client side validation, and plugin integration.	CLO3
15	Dynamic client-side interactions using AJAX and JSON for asynchronous data exchange, along with partial view rendering and updating to enhance user experience without full page reloads.	CLO3
16	Session and cookie management and secure handling of user-specific data in ASP.NET Core. Deployment of ASP.Net Core Web application.	CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC415 Web Technologies

Course Description

A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and HTML/XML to provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting. Students are required to plan, design and implement a major project.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Describe the building blocks of a web application.	PLO-01	Cognitive	2. Understand
CLO2	Implement client-side scripting technologies	PLO-04	Cognitive	3. Apply
CLO3	Develop a complete web application using both client-side and server-side programming languages.	PLO-04	Cognitive	5. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Web Technologies and History of web and Internet Design principles of Web-based applications, Web platform constraints	1
2	Software as a Service (SaaS), Web standards Introduction to HTML and Introduction to CSS	1
3	Responsive Web Design Discussion on HTML + CSS	1
4	Introduction to Client Side Programming: JavaScript Input Validation	2
5	Introduction to JQUERY; JQUEY +HTML+CSS Website	1, 2
6	Data Intensive Web Applications; Web Server, Application Server, Database Server; MySQL: Data & Data Objects Manipulations via SQL	3

7	Server side scripting Technology: PHP - An Introduction, Server Side Variables; Request, Response	3
8	Review: HTML, CSS, JavaScript, JQuery, Bootstrap, SQL, PHP (Syntax, Variables, Operators, Control Instructions, Loop Instructions)	1, 2, 3
9	Midterm Exams	
10	Browser/Server Communication, Storage Tier Database Programming with PHP	1, 3
11	Web App Security - Browser Isolation, Network Attacks, Session Attacks, Session Handling, Cookies Handling	1, 3
12	Large scale applications, Performance of Web Applications File Handling in PHP	1, 3
13	Web Testing and Web Maintenance File Uploading in PHP	1, 3
14	Content Management System: WordPress	1, 2, 3
15	Search Engine Optimization, Semantic Web, Future Web Application Framework. Large scale applications, A Complete Web Project	1, 2, 3
16	Semester Projects: Presentation & Evaluation	1, 2, 3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC351 Machine Learning

Course Description

This course introduces students to the fundamentals of Machine Learning, focusing on algorithms that enable computers to learn from data. Students will explore key concepts such as supervised and unsupervised learning, model evaluation, and data preprocessing. Through practical examples and hands-on exercises, the course bridges theory and real-world applications in areas like classification, regression, and clustering.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Apply basic machine learning algorithms such as regression, classification, and clustering using appropriate tools and techniques to solve problems.	PLO-01	Cognitive	3. Apply
CLO2	Analyze datasets and evaluate machine learning models using appropriate techniques such as cross-validation, confusion matrices, and performance metrics.	PLO-03	Cognitive	5. Evaluate
CLO3	Design and develop end-to-end machine learning solutions for real-world problems by integrating data preprocessing, algorithm selection, and model tuning.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Machine Learning, Supervised vs. Unsupervised Machine Learning	1
2	Bayes Theorem, Bayesian Decision Theory, how to apply in Machine Learning?	1
3	What are Parametric Methods? Parametric Machine Learning Methods, Logistic Regression, Linear Discriminant Analysis	1,2
4	Non-parametric Methods, Decision Trees	1,2
5	Multivariate Analysis & Methods, Multivariate Regression,	2
6	Perceptron, Single Layer & Multilayer Perceptron, Simple Neural	1

	Network	
7	Activation Functions, How Neural Networks work?	1
8	Model Building in Machine Learning, Local vs. Global Models	3
9	Midterm Exams	
10	Kernel Methods & Machines, Support Vector Machine	3
11	Hidden Markov Models	3
12	Ensemble methods: Bagging, Boosting, Random Forests	2
13	Reinforcement Learning	3
14	Introduction to Deep Neural Networks	2
15	Generative AI, Role of Machine Learning in GenAI	1,2
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC352 Introduction to Deep Learning

Course Description

Introduction to Deep Learning is a foundational course designed to explore the core principles and techniques that power modern artificial intelligence. This course introduces key concepts such as neural networks, backpropagation, activation functions, and model training. Through hands-on projects and real-world examples, students will understand how deep learning is applied in areas like computer vision, natural language processing, and reinforcement learning. By the end of the course, participants will be equipped with the skills needed to build, train, and evaluate their own deep learning models.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the fundamental concepts of deep learning and neural networks.	PLO-01	Cognitive	2. Understand
CLO2	Analyze and compare different deep learning architectures and their applications.	PLO-03	Cognitive	4. Analyze
CLO3	Design and develop deep learning solutions for real-world tasks in Computer Vision, Natural Language Processing, and other domains.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Deep Learning, History, trends, applications	1
2	Mathematical Foundations, Linear algebra, calculus, probability, Basics of Neural Networks, Activation Functions	1
3	Backpropagation, optimization, Gradient descent	1
4	Feedforward Neural Networks, Batch Normalization, Drop-out, Early Stopping	1
5	Convolutional Neural Networks	2, 3
6	CNN Architectures, LeNet, AlexNet, VGG, ResNet	2, 3
7	Sequence Modeling and Recurrent Neural Networks,	2, 3

8	Gated Recurrent Unit, Long Short-Term Memory	2, 3
9	Midterm Exams	
10	Generative Networks, Generative Adversarial Networks	2, 3
11	Autoencoders, Variational Autoencoders	2, 3
12	Attention and Transformers, Self-attention, BERT, GPT	2, 3
13	Large Language Models, Modeling Natural Language	2, 3
14	Generative AI, Role of Deep Learning in GenAI	2, 3
15	Prompt Engineering, Retrieval Augmented Generation	2, 3
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC354 Computer Vision and Image Processing

Course Description

This course introduces fundamental concepts and techniques for image' processing and computer vision. This course covers major topics related to image acquisition, human visual perception, sampling and quantization, image enhancement, image, restoration, linear and nonlinear, filtering, morphological operations, noise removal, image deblurring, edge detection, image/video compression, feature extraction, and object recognition and image understanding.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the fundamentals and core concepts of image processing related to image segmentation, compression, and enhancement and camera calibration.	PLO-01	Cognitive	2. Understand
CLO2	Apply image processing and computer vision fundamentals for image enhancement, segmentation and feature extraction.	PLO-02	Cognitive	3. Apply
CLO3	computer vision applications using image processing, computer vision and deep learning techniques.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts, Image acquisition, Display using digital devices	1
2	Image enhancement in spatial domain: Intensity transformations, Histogram and its analysis, Convolution and spatial filtering	1,2
3	Image enhancement in frequency domain a. Basic concepts related to Fourier transform b. Sampling in frequency domain and introduction to DFT c. Filtering in frequency	1,2
4	Image restoration a. Introduction to restoration model b. Different types of noises and their models	1,2

	c. Image restoration in spatial and frequency domains	
5	Morphological operations for binary and gray images	1,2
6	Color image processing a. Formation of color image b. Different color models c. Analysis of colored images	1
7	Image compression a. Compression models, compression ratio, types of redundancy b. Variable length coding c. Lossy and lossless compression	1
8	Image filtering and Image Segmentation	2
9	Midterm Exams	
10	Image Descriptors and Features: edges, corners, texture based features	2
11	Image Descriptors and Features: edges, corners, texture based features	2
12	Application of Deep Learning in computer vision	3
13	Applications of Computer Vision: Artificial Neural Network for Pattern Classification, Convolutional Neural Networks	2,3
14	Applications of Computer Vision: Object Recognition and Image Understanding	2,3
15	Applications of Computer Vision: Object Recognition and Image Understanding	2,3
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC451 Natural Language Processing

Course Description

This course is designed to introduce students to the fundamental concepts and ideas in natural language processing (NLP) and to get them up to speed with current research in the area. It develops an in-depth understanding of both the algorithm available for the processing of linguistic information and the underlying computational properties of natural languages. Word level, syntactic, and semantic processing from both a linguistic and an algorithmic perspective are considered. The focus is on modern quantative techniques in NLP: using large corpora, statistic models for acquisition, disambiguation, and parsing. Also, it examines and constructs representative systems.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain core concepts and techniques of NLP for word level and syntactic word processing	PLO-01	Cognitive	2. Understand
CLO2	Use appropriate technique on large unstructured and unlabeled text to extract useful information for a variety of NLP tasks	PLO-02	Cognitive	3. Apply
CLO3	Design and develop solution for syntax and semantic processing	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Course, Python, file reading and writing in python, word counting	CLO1
2	Basic Text Processing • Word Tokenization • Word Normalization • Lemmatization • Morphology • Stemming • Sentence Segmentation • Regular Expressions	CLO1
3	Edit Distance and Text Similarity • Levenshtein Algorithm • Backtrace for Computing Alignments	CLO1

4	Language Modeling Joint Probability of Word Chain Rule Unigram, Bigram and Trigram Modeling Estimating N-gram Probabilities	CLO2
5	Language Modeling Smoothing Laplace Smoothing Backoff and Interpolation Advanced smoothing algorithms Good-Turing smoothing	CLO2
6	Advanced Smoothing Algorithms: Kneser-Ney Smoothing Neural Language Models BERT, GPT-3	CLO2
7	Part of Speech Tagging	CLO1
8	Text Classification Naïve Bayes for Text Classification Naïve Bayes with Laplace Smoothing Text Classification: Evaluation (Precision, Recall, F-measure)	CLO3
9	**Mid-Term**	
10	Chatbot Sentiment Analysis	CLO3
11	Machine Translation	CLO3
12	Syntactic Parsing Introduction Top-down parsing Bottom-up parsing Structural ambiguity	CLO3
13	Syntactic Parsing Treebank Context Free Grammars Probabilistic Context-Free Grammars CKY Parsing	CLO3
14	Lexical Semantics and Text Resources Wordnet: Word meaning and similarity Similarity algorithms Path based similarity Information content based similarity Cosine similarity	CLO3
15	Question Answering What is Question Answering? Answer Types and Query Formulation Passage Retrieval and Answer Extraction Using Knowledge in QA	CLO3
16	Revision	

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC380 Introduction to Data Science

Course Description

This course introduces students to the basics of Data Science including programming in Python, statistical inference, exploratory data analysis, basic machine learning algorithms, feature generation and feature selection. The foundation is laid for data analyses ranging from social networks to business informatics.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the key concepts of data science, statistical modeling & inference.	PLO-01	Cognitive	2. Understand
CLO2	Apply exploratory data analysis on real-world datasets.	PLO-02	Cognitive	3. Apply
CLO3	Evaluate patterns and relationships within datasets by assessing the effectiveness of basic statistical techniques and machine learning algorithms.	PLO-04	Cognitive	5. Evaluate

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	What is data science? Big Data hype, Skill set needed for a data scientist. Basic Statistics, Statistical Inference, Probability Distributions	1
2	Normal Distribution, Z-Distribution & Z-Score, Z-test for Hypothesis Testing	1
3	Introduction to Python, Basic concepts, Numpy and Pandas libraries	1
4	Data handling in Python, Linear Regression with Least Square Method, Model Fitting in Python	1
5	Exploratory Data Analysis, EDA in data science, Basic tools (graphs, summary), Univariate and Bivariate Analysis, Matplotlib and Seaborn libraries	2
6	Case studies on Exploratory Data Analysis, Social, Medical and Business Data Exploration, Multivariate Analysis, How to describe a plot?	2

7	Basics of Machine Learning, Supervised vs. Unsupervised Learning, Linear Regression with Gradient Descendant, Classification using k-Nearest Neighbors	3
8	K-means for Clustering, Elbow Method to find K in K-means, Naïve Bayes, Spam Filtering	3
9	Midterm Exams	
10	Evaluation Metrics for Machine Learning Models, Confusion Matrix for Binary and Multiclass classification, Data Cleaning, Data Transformation (Label encoding, One Hot Encoding), Feature Scaling (Min-Max Normalization, Standardization)	3
11	Feature Generation and Selection, Up-sampling, Down-sampling, Filters; Wrappers; Decision Trees; Random Forests.	3
12	Dimensionality Reduction, Principal Component Analysis	3
13	Singular Value Decomposition, Recommendation Systems	3
14	Steps to build a Model in Machine Learning, Bias and Variance Tradeoff, Overfitting and Underfitting, How to detect Underfitting and Overfitting?	3
15	Generative AI, Prompt Engineering, Future Trends in Data Science, Data Science and Ethical Issues	3
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC481 Cloud Computing

Course Description

This course introduces the fundamental concepts, models, and technologies of cloud computing, with an emphasis on hands-on experience using Amazon Web Services (AWS) Free Tier. It is beginner friendly and aligns with international industry needs. Students will explore cloud deployment models, service models (IaaS, PaaS, SaaS), virtualization, containerization (intro), cloud storage, identity/access management, and serverless computing. Emphasis is placed on practical applications using AWS, helping students develop job-ready skills and apply cloud solutions in real-world scenarios such as web hosting, data backup, and automated deployment.

Course Learning Outcomes (CLOs)

CLO No.	Description	PLOs	Domain	Domain Level
CLO1	Explain the core concepts, service and deployment models of cloud computing and discuss the benefits and limitations of cloud-based solutions.	PLO-01	Cognitive	2: Understand
CLO2	Use core cloud services such as compute, storage, networking, databases to deploy and manage cloud-based solutions.	PLO-03	Cognitive	3: Apply
CLO3	Analyze cloud service configurations for performance, security, scalability, interoperability and cost efficiency for application deployment and monitoring.	PLO-05	Cognitive	4: Analyze

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Cloud Computing	CLO1
2	Cloud Service Models (**X**aaS: IaaS, PaaS, SaaS) Deployment Models (Public, Private, Hybrid, Community)	CLO1
3-4	Virtualization Concepts: VMs, Containers (basic), Hypervisors	CLO1, CLO2
5	Storage Services: S3, EBS, Glacier, Object vs Block Storage	CLO2
6	Networking Basics in Cloud: IP, DNS, Load Balancing, CDN, VPC	CLO2
7	IAM: Identity & Access Management, Users, Roles, Policies	CLO2

8	Serverless Computing: Lambda Functions (No-code and code-based triggers)	CLO1, CLO2
9	Midterm	
10	Cloud Databases Overview: RDS, DynamoDB, basic CRUD operations	CLO2
11	Auto Scaling and Monitoring: CloudWatch basics, Health Checks	CLO2, CLO3
12	Web Hosting with Cloud: Domain routing, Route 53, Static and Dynamic hosting	CLO2
13	Backup and Disaster Recovery, Snapshots, Versioning	CLO2, CLO3
14	Cloud Security & Compliance: Shared responsibility model, access control	CLO1, CLO3
15	Cost Optimization: Free Tier usage, Pricing Models, AWS Calculator	CLO3
16	Capstone Project Planning: Propose a real-world application using AWS,	CLO1, CLO2, CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC482 Internet of Things

Course Description

This course typically covers fundamental concepts, architecture, and various aspects of IoT technology. It includes topics like IoT introduction, architecture, communication protocols, data handling (acquisition, storage, analysis), security, and project development.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the basics of Internet of Things including sensors and distributed networks.	PLO-01	Cognitive	2. Understand
CLO2	Examine various network protocols used in IoT.	PLO-02	Cognitive	4. Analyze
CLO3	Explain the role of big data, cloud computing and data analytics in a typical IoT system.	PLO-01	Cognitive	2. Understand

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction – Concepts behind the Internet of Things. The IoT paradigm, Application domain	1
2	IoT Hardware, Sensors, IoT Devices	1
3	Sensors in a Distributed Environment	1
4	IoT Software, IoT Platforms, Machine-to-Machine Communication, Distributed Networks for IoT.	1
5	Wireless Networks, Wireless Sensor Networks, Distributed Networks	1
6	IoT protocol stack	2
7	Application Layer, MQTT, CoAP	2
8	Network Layer, 6LoWPAN	2
9	Midterm Exams	
10	Routing Protocol, RPL	2
11	Service Discovery, mDNS, DNS-SD	2

12	Cloud & IoT Integration	3
13	Data Analytics in IoT systems	3
14	Social IoT, Exploring the role of Big Data, Cloud Computing and Data Analytics in IoT systems.	3
15	Smart Buildings to Smart Cities	3
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: CSC391 Game Development

Course Description

This course introduces game development process. Students will learn game application development using Unity3D, a cross-platform and user-friendly game engine developed by Unity Technologies. Topics include job roles in game development, introduction of popular game engines, game design, Unity Editor essentials, game optimization, game deployment on target machines and production. Unity Editor Essentials contain game scenes, objects, input and event management, particle systems, lightning, animations, sound and music, AI based navigation, User Interface and game behavior. Students are expected to work on a project that produces a mini game application.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the role of game objects, components, and imported assets in creating interactive scenes in Unity3D.	PLO-01	Cognitive	2. Understand
CLO2	Build interactive behaviors by integrating scripting, input system, physics, and basic AI.	PLO-02	Cognitive	3. Apply
CLO3	Analyze game prototypes against project documentation and collaborative feedback.	PLO-05	Cognitive	4. Analyze
CLO4	Design game UI, animations, audio, lighting, and particle systems to enhance gameplay experience.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)

1	• Job Roles in Game Development
	• Introduction to Game Engines
	  ○ Comparison of popular Game Engines
	• Introduction to Unity3D
	  ○ Installation
	  ○ Project Creation
	  ○ Project Structure
	  ○ Official Documentation
		CLO1

2	• Scenes & Game Objects
	  o Game Objects and components
	  o Manipulating components
	  o Object Hierarchies
	  o Parenting of objects
	• Importing & Integrating Assets
	  o Importing assets from the internet, Asset Store and Unity Packages
	  o Integrating assets, textures, meshes
	  o Configuring assets, textures, meshes
	  o Assembling the scene
		CLO1

3	• Terrain
	  o Understanding a landscape with Terrain
	  o Discussing Height Maps
	  o Probuilder
		CLO1

4	• Unity Input System
	  o Creating Input Mappings
	  o Using Mappings in our scripts
		CLO2

5	• Introduction to C# scripting for game development
	  o Creating a C# script
	  o Adding fields
	  o Event Management
		CLO2

6	• Game Design Document
	  o Description of game
	  o Description of gameplay involved
	  o Description of game goals, puzzles, and characters
	  o Illustrations, Maps, Storylines
	  o Technical Information
	  o Game design Feedback
		CLO4

7	• Math & Physics
	  o Configuring physics
	  o Setting shapes
	  o Filtering & detecting collisions
	  o Detecting Trigger events
	  o Moving with physics & Applying forces
	  o Tweaking physics
		CLO2

8	• Particle Systems
	  o Creating a basic particle system
	  o Creating a waterfall effect
	  o Creating a bonfire effect
		CLO4

9	Midterm Exams	
10	• Behavior & AI	CLO2

	○ Implementing Game AI for Building Enemies	
11	• Sound and Music ○ Importing audio ○ Audio types ○ Using 2D and 3D Audio Sources ○ Using an Audio Mixer	CLO4
12	• User Interface ○ Creating a UI with the Canvas ○ Creating UI controls ○ Creating a responsive UI	CLO4
13	• Animation & Movement ○ Using Skinning Animation with Animator ○ Understanding skinning ○ Importing skeletal animations ○ Integration using Animation Controllers	CLO4
14	• Lighting ○ Applying lighting ○ Discussing lighting methods ○ Configuring ambient lighting with skyboxes ○ Understanding static lighting ○ Baking lightmaps	CLO4
15	• Game Production, deployment and Profiling ○ Building a project ○ Debugging the build ○ Debugging code Profiling performance	CLO3
16	Semester Project	CLO1 CLO2 CLO3 CLO4

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-211 Software Requirements Engineering

Course Description

This course introduces students to the process of software requirements engineering and helps them understand important issues in Requirements Engineering (RE). This course will help students to learn and apply the RE concepts such as elicitation, specification, modeling, and analysis of software requirements. Important topics include Requirement types, levels of requirements, Requirements management, validation, and traceability of requirements. Moreover, RE for agile methods will also be discussed.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Perform requirement engineering process.	PLO-01	Cognitive	3. Apply
CLO2	Analyze software requirements for the development of cost-effective and efficient solutions.	PLO-03	Cognitive	4. Analyze
CLO3	Generate functional and non-functional requirements specifications along with a validation plan for a software.	PLO-04	Cognitive	6. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Requirement Engineering, Software Requirements	CLO1
2	Kinds of Software Requirements Non-Functional, Domain, Inverse, Design and Implementation Requirements, Functional Requirements	CLO1
3	Requirement Process Levels/layers of requirements	CLO1
4	Requirement Models Business Requirements: vision, scope, context diagram, ecosystem maps, events list, feature trees	CLO1
5	User Requirements: User Stories & Use cases modelling.	CLO1
6	Requirements Elicitation	CLO2

7	Requirements Elicitation	CLO2
8	Requirements Analysis, Modeling and Specification	CLO2
9	Midterm Exams	
10	Requirements Specification & Documentation	CLO3
11	Requirements Management	CLO2
12	Requirements Validation	CLO3
13	Requirements Traceability	CLO2
14	Requirements Engineering for Agile Methods and Their Approaches to Requirements Elicitation and Management	CLO3
15	Requirements Effort estimation and Velocity COCOMO II, Planning Poker	CLO2
16	Final Exams	

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-222 Software Design and Architecture

Course Description

Software Design and Architecture introduces the essential concepts of software Development. The concepts and command to develop strong architecture and design are essential for developing state-of-the art applications. The course will provide a strong foundation to students to come up with the skills necessary to develop architecture and realize it in design for developing applications fulfilling both functional and non-functional requirements. Different architectural styles and object-oriented design patterns will be taught which will help students to analyze, select and implement design strategies required to realize the selected architecture.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain processes for software products and engineering design.	PLO-01	Cognitive	2. Understand
CLO2	Apply appropriate Architectural Styles and Design Patterns to design a software.	PLO-04	Cognitive	3. Apply
CLO3	Construct UML Diagrams for a software	PLO-04	Cognitive	5. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Software Design Concepts Design principles Processes for software products and engineering design	1
2	Types of Software Designs Introduction to Object-Oriented Design Introduction to System design and software architecture	1,2
3	Software Architectures: Layered Style Architectures Pipe-and-Filter Style Architectures Shared-Data Style Architectures	2
4	Event-Driven Style Architectures Model-View-Controller Style Architectures Hybrid Architectures	2
5	Software Designing with UML: Use Case Diagram Class Diagram	3

	Object Diagram	
6	Sequence Diagram Collaboration Diagram Component Diagram	3
7	Activity Diagram State Machine Diagram	3
8	Package Diagram Deployment Diagram	3
9	Midterm Exams	
10	Object Oriented Software Design Patterns: The Abstraction-Occurrence Pattern The General Hierarchy Pattern	2
11	The Player-Role Pattern The Singleton Pattern	2
12	The Observer Pattern The Delegation Pattern	2
13	The Adapter Pattern The Façade Pattern	2
14	The Immutable Pattern The Read-only Interface Pattern	2
15	The Proxy Pattern The Factory Pattern	2
16	Coupling and Cohesion	1

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-222L Software Design and Architecture Lab

Course Description

Software Design and Architecture introduces the essential concepts of software Development. The concepts and command to develop strong architecture and design are essential for developing state-of-the art applications. The course will provide a strong foundation to students to come up with the skills necessary to develop architecture and realize it in design for developing applications fulfilling both functional and non-functional requirements. Different architectural styles and object-oriented design patterns will be taught which will help students to analyze, select and implement design strategies required to realize the selected architecture.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Demonstrate processes for software products and engineering design.	PLO-01	Cognitive	2. Understand
CLO2	Implement appropriate Architectural Styles and Design Patterns to design software using an object-oriented programming language.	PLO-04	Cognitive	3. Apply
CLO3	Design softwares using Unified Modeling Language.	PLO-04	Cognitive	5. Create
CLO4	Comply with ethics and professional practices in computing.	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Implementation of software products and engineering design in C#	1
2	Implementation of Object-Oriented Design in C#	1
3	Implementation of Software Architectures in C#: Layered Style Architectures Pipe-and-Filter Style Architectures Shared-Data Style Architectures	2
4	Implementation of Software Architectures in C#: Event-Driven Style Architectures Model-View-Controller Style Architectures Hybrid Architectures	2
5	Development of Software using Object Oriented design in C#: Software Designing with UML:	3

	Use Case Diagram Class Diagram Object Diagram	
6	Development of Software using Object Oriented design in C#: Sequence Diagram Collaboration Diagram Component Diagram	3
7	Development of Software using Object Oriented design in C#: Activity Diagram State Machine Diagram	3
8	Development of Software using Object Oriented design in C#: Package Diagram Deployment Diagram	3
9	Midterm Exams	
10	Implementation of Software Design Patterns in C#: The Abstraction-Occurrence Pattern The General Hierarchy Pattern	2
11	Implementation of Software Design Patterns in C#: The Player-Role Pattern The Singleton Pattern	2
12	Implementation of Software Design Patterns in C#: The Observer Pattern The Delegation Pattern	2
13	Implementation of Software Design Patterns in C#: The Adapter Pattern The Façade Pattern	2
14	Implementation of Software Design Patterns in C#: The Immutable Pattern The Read-only Interface Pattern	2
15	Implementation of Software Design Patterns in C#: The Proxy Pattern The Factory Pattern	2
16	Implementation of Coupling and Cohesion in C# Project Evaluation	1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-323 Software Construction & Development

Course Description

This course introduces the principles and practices of software construction, including code layout, design, testing, and maintenance. Students will apply software construction techniques to develop and improve software systems, with a focus on writing clean, maintainable, and high-quality code using modern development practices.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the fundamental principles and practices of software construction.	PLO-01	Cognitive	2. Understand
CLO2	Apply software construction techniques to develop software projects.	PLO-04	Cognitive	3. Apply
CLO3	Apply appropriate techniques to improve the quality of existing code.	PLO-04	Cognitive	3. Apply

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Software Construction • Overview of Course • Overview of SDLC	CLO1
2	Personal Software Process (PSP), Team Software process (TSP) Software Construction Fundamentals Key Construction Decisions: • Choice of Programming Language • Programming Conventions • Localization Aspects of Technology • Selection of Construction Practices.	CLO1
3	Layout and Style: • Layout Fundamentals • Layout Techniques • Layout Styles • Laying Out Individual Statements • Laying Out Control Structures • Laying Out Routines, Laying Out Classes • Laying Out Comments Documenting and commenting source code	CLO1 CLO2

4	Design in Construction • Object Oriented Design	CLO2
5	Design in Construction • SOLID Design Principles	CLO2
6	Design in Construction • Design Patterns	CLO2
7	Design in Construction • Design Patterns	CLO2
8	Software Testing Defensive Programming • Assertions • Error & exception handling • Debugging • Fault Tolerance Code Review Techniques • Personal Reviews • Peer Reviews	CLO3
9	Midterm Exams	
10	Software Deployment Process Distribution and backup	CLO2
11	Software Configuration Management Software Configuration Management Process Release Management • Version Control & Collaboration	CLO2
12	Principles of Software Maintenance Lehman's Laws of evolution	CLO3
13	Legacy Systems Apply Michael Feathers concepts on Legacy code	CLO3
14	Refactoring	CLO3
15	Refactoring	CLO3
16	Revision	CLO1 CLO2 CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-323L Software Construction & Development Lab

Course Description

This lab course introduces fundamental principles and practices of software development with a focus on building error-free, readable, and maintainable object-oriented programs. It focuses on challenges related to code complexity, changeability, and reusability. Through individual assignments and team projects, students will gain hands-on experience in unit development, integration, and collaborative programming.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Apply structured and object-oriented programming principles to construct modular software solutions.	PLO-01	Cognitive	3. Apply
CLO2	Apply software construction tools to build, test, and deliver reliable applications.	PLO-05	Cognitive	3. Apply
CLO3	Analyze software components and practices to improve code quality and maintainability.	PLO-03	Cognitive	4. Analyze
CLO4	Comply with ethics and Professional practices in computing	PLO-09	Affective	3. Valuing

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Setting up the development environment (IDE) 1. Eclipse, IntelliJ Idea, Netbeans Writing and running simple Java program	CLO1
2	Java Programming Fundamental 1. Variables, Data Types, Operators 2. Input & Output 3. Control Structures: o Decision Making statements (if-else, switch) o Loop statements (while, do-while, for, for-each) o Jump statements (break, continue) 4. Data Structures: Arrays, LinkedList, ArrayList, HashMap, HashSet	CLO1
3	Object Oriented Programming (Java) • Classes & Objects • Constructors	CLO1

	• Encapsulation • Polymorphism: Method overloading and overriding • Inheritance • Abstraction: Abstract Class, Interface	
4	File Handling, exception handling Database Integration using Java	CLO2
5	Practical implementation of SOLID Design Principals	CLO1
6	Practical implementation of SOLID Design Principals	CLO2
7	Practical implementation of Design Patterns	CLO1
8	Practical implementation of Design Patterns	CLO2
9	Midterm Exams	
10	Writing and running JUnit tests Debugging Java applications using an IDE Introduction to JavaFX for GUI development	CLO2 CLO3
11	Building a Java project with Maven/Gradle Deploying a Java application Java Profiling	CLO2
12	Introduction to GitHub version control system Introduction to Continuous Integration, and Continuous Delivery (CICD) automation tools	CLO2 CLO3
13	Code Refactoring in Java	CLO3
14	Code Refactoring in Java	CLO3
15	Project Design Document	CLO1 CLO2 CLO3
16	Project Evaluation	CLO1 CLO2 CLO3

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-331 Software Quality Engineering

Course Description

This graduate-level course provides a comprehensive understanding of software quality engineering, focusing on core concepts, models, and processes to ensure software reliability and maintainability. Students will explore testing strategies, quality assurance techniques, and their application throughout the software development lifecycle. The course also introduces advanced and emerging research areas in software quality engineering.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Understand software quality concepts, attributes, and the software testing life cycle.	PLO-01	Cognitive	2. Understand
CLO2	Apply appropriate testing strategies, techniques, and tools to verify and validate software systems.	PLO-02	Cognitive	3. Apply
CLO3	Analyze testing processes, metrics, and automation practices to ensure software reliability and quality.	PLO-03	Cognitive	4. Analyze

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	**Introduction to Software Quality** • What is Software Quality? • Software Quality Attributes • Causes of Software Defects • Why Testing is Necessary? • Introduction to Software Quality Engineering	CLO1
2	**Software Testing Basics** • Testing Concepts and Terminologies • Software Testing Life Cycle (STLC) • Testing Issues and Techniques • Testing Scopes and Objectives • The Psychology of Testing	CLO1
3	**Testing Process and Planning** • Requirement Analysis for Testing	CLO1 CLO2

	• Test Planning Process • Testing Principles • Testing Approaches (Black-box, White-box, Gray-box) • Introduction to Testing Documentation	

4	**Testing Strategies and Techniques**
	• Testing Strategies (Top-down, Bottom-up, Big Bang)
	• Software Testing Techniques:
	  ○ Equivalence Partitioning
	  ○ Boundary Value Analysis
	  ○ Decision Table Testing
	• Test Levels:
	  ○ Unit Testing
	  ○ Integration Testing
	  ○ System Testing
	  ○ Acceptance Testing
		CLO2

5	**Advanced Testing Models** • Model-Based Testing • Domain and Combinatorial Testing • Functional vs Non-Functional Testing • Regression Testing and Impact Analysis • Test Automation Introduction	CLO2 CLO3
6	**Reliability and Static/Dynamic Testing** • Software Reliability Engineering • Reliability Growth Models (e.g., Musa's Model) • Static Testing (Reviews, Inspections) • Dynamic Testing • Test Slicing Techniques	CLO3
7	**Software Reviews and Metrics** • Formal & Informal Reviews • Review Process and Documentation • Inspection Checks and Metrics • Introduction to Quality Models	CLO3
8	**Test Automation Tools** • Importance of Test Automation • Selenium Basics (Browser Automation Tool) • How to Use Automation Tools • Unit Testing with JUnit/TestNG	CLO2
9	Midterm Exams	
10	**Testing Metrics and Process Control** • In-Process Testing Metrics • In-Process Quality Management • Effort vs Outcome Models	CLO3

11	**System Testing and Risk-Based Testing** • System and Subsystem Testing • Risk and Testing • Incident Management Process	CLO2 CLO3
12	**Structural Testing Techniques** • Path-Based Testing • Data Flow Testing • Slice Testing • Use Cases for Testing	CLO2

13	**Specification-Based and Lifecycle Testing**
	• Specification-Based Testing
	• Lifecycle-Based Testing Approaches:
	  ○ Waterfall
	  ○ Iterative
	  ○ Agile Testing
	  ○ Pros and Cons of Each Model
		CLO2
		CLO3

14	**Object-Oriented Testing**
	• Object-Oriented Testing Concepts
	• Challenges in OO Testing:
	  ○ Composition
	  ○ Encapsulation
	  ○ Polymorphism
		CLO3

15	Capstone Project	CLO1 CLO2 CLO3
16	Capstone Project	CLO1 CLO2 CLO2

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-341 Software Project Management

Course Description

This course provides a thorough understanding of the principles, practices, and challenges involved in managing software projects. Students will explore the complete project lifecycle, from initiation and planning to execution, monitoring, and closure. Emphasis is placed on core project management knowledge areas, including scope, time, cost, quality, risk, and stakeholder management. The course covers modern estimation techniques, scheduling tools such as Work Breakdown Structures and Critical Path Method, and software lifecycle models like waterfall, prototyping, and iterative development. Students will also learn to analyze stakeholder roles, tailor project plans, manage project documentation, and build effective teams. Advanced topics such as software quality assurance, risk mitigation, and monitoring and control processes are also discussed. Through practical scenarios and case-based learning, students will gain the skills to plan and manage real-world IT projects effectively.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the fundamental concepts, principles, and processes of software project management	PLO-01	Cognitive	2. Understand
CLO2	Apply project planning techniques such as WBS, scheduling, and estimation models to develop realistic and tailored project plans.	PLO-06	Cognitive	3. Apply
CLO3	Analyze project documentation, stakeholder roles, and organizational structures to ensure effective team collaboration and communication.	PLO-03	Cognitive	4. Analyze
CLO4	Examine software project risks and quality management practices using established models and monitoring techniques.	PLO-03	Cognitive	4. Analyze

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Overview of software project management principles and its importance in IT project success.	1

2	Factors contributing to success or failure; case studies and lessons learned.	1
3	Key skills needed for managing software projects: leadership, communication, and negotiation.	1
4	Differences between general engineering practices and software engineering processes.	1
5	Understanding the common characteristics across different types of projects.	1
6	Introduction to PMI's PMBOK framework and its ten knowledge areas (scope, time, cost, etc.).	3
7	Identifying stakeholders and understanding key documents like project charter, SOW, and plans.	3
8	How to customize project plans and construct a Work Breakdown Structure (WBS) for planning.	2
9	Midterm Exams	
10	Introduction to effort estimation: Function points, object points, and complexity analysis.	2
11	Explore cost estimation using basic and intermediate COCOMO models and their limitations.	2
12	How to create realistic project schedules using CPM, float, and timeline normalization.	2
13	Understand project team roles, structures (matrix, functional), and effective team collaboration.	3
14	Overview of SEI Risk Paradigm, risk planning, mitigation, and quality control activities.	4
15	Techniques for tracking progress, managing change, and evaluating project performance.	4
16	Review	1,2,3,4

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-442 Software Re-engineering

Course Description

This course explains and applies best practices to analyze and understand existing software systems; Use heuristics and tools to detect shortcomings in the design and implementation of software systems; Apply tests and re-factoring techniques to systematically remove the shortcoming and forward engineering techniques to re-build the software for fitness of purpose.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Explain the Concepts and techniques of software re- engineering	PLO-01	Cognitive	2.Understand
CLO2	Apply re-engineering techniques to maintain and modify software systems	PLO-02	Cognitive	3. Apply
CLO3	Classify the maintenance related problems associated with object-oriented software systems.	PLO-01	Cognitive	4. Analyze

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction of the course, definition of legacy project, characteristics, legacy culture, SW evolution process, maintenance effort distribution, prediction	1
2	SW reengineering process, detailed discussion on each phase of Reengineering process	1
3	Software Evolution Process, Program Types, Laws of SW evolution, implications of the laws, evolution of open-source software, SW models, top down and bottom-up SW evolution	2
4	Using the dual approach, requirement-driven SW evolution, SW evaluation techniques, unified process, architecture & synthesis process, scenario based, design patterns	2
5	Challenges, classification of challenges, preserving SW quality	3
6	SW re-documentation, renovation, technologies & architectures, measurable benefits, General model for software reengineering revisited.	2

7	Reengineering Phases and Tasks, Hybrid Reengineering approach and risks, benefits, and metrics.	2
8	Code slicing, static and dynamic slicing, other types of slicing, applications of program slicing.	3
9	Midterm Exams	
10	Refactoring revision	2
11	Software Construction and Development Project Implementation, Evaluation	3
12	Re architecting, breaking an application into modules, distributing web application into services	3
13	Choosing architecture, technical and organizational benefits and challenges	2
14	Stop writing legacy SW, update documentation, foster communication, periodic code reviews, automate, small is beautiful	1
15	Discussion and evaluation of projects	2
16	Revision	1,2,3

University of Engineering and Technology Lahore
Course Outline Report
Subject: SE-326 Principles of Web Engineering

Course Description

A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and HTML/XML to provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting. Students are required to plan, design and implement a major project.

Course Learning Outcomes (CLOs)

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Describe the building blocks of a web application.	PLO-01	Cognitive	2. Understand
CLO2	Implement client-side scripting technologies	PLO-04	Cognitive	3. Apply
CLO3	Develop a complete web application using both client-side and server-side programming languages.	PLO-04	Cognitive	5. Create

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Web Technologies and History of web and Internet Design principles of Web-based applications, Web platform constraints	1
2	Software as a Service (SaaS), Web standards Introduction to HTML and Introduction to CSS	1
3	Responsive Web Design Discussion on HTML + CSS	1
4	Introduction to Client Side Programming: JavaScript Input Validation	2
5	Introduction to JQUERY; JQUEY +HTML+CSS Website	1, 2
6	Data Intensive Web Applications; Web Server, Application Server, Database Server; MySQL: Data & Data Objects Manipulations via SQL	3

7	Server side scripting Technology: PHP - An Introduction, Server Side Variables; Request, Response	3
8	Review: HTML, CSS, JavaScript, JQuery, Bootstrap, SQL, PHP (Syntax, Variables, Operators, Control Instructions, Loop Instructions)	1, 2, 3
9	Midterm Exams	
10	Browser/Server Communication, Storage Tier Database Programming with PHP	1, 3
11	Web App Security - Browser Isolation, Network Attacks, Session Attacks, Session Handling, Cookies Handling	1, 3
12	Large scale applications, Performance of Web Applications File Handling in PHP	1, 3
13	Web Testing and Web Maintenance File Uploading in PHP	1, 3
14	Content Management System: WordPress	1, 2, 3
15	Search Engine Optimization, Semantic Web, Future Web Application Framework. Large scale applications, A Complete Web Project	1, 2, 3
16	Semester Projects: Presentation & Evaluation	1, 2, 3