15B11CI212 Theoretical Foundations of Computer Science

Propositional and predicate Logic, Proof techniques: Sets, Functions, Recursion, induction, Counting, combinatorics; Relations, closures of relations, equivalence relations, partial orderings, Hasse diagrams, lattices; Graphs, Euler and Hamiltonian paths, planar graphs, graph coloring problem, Boolean algebra, Binary arithmetic, algebraic structures, properties and applications; Introduction to Automata theory: Finite Automata and Regular languages, regular expressions, DFA, NFA, non-regular languages, context-free languages, Turing machine and its examples.

Subject Code	**15B11CI212**	Semester: Third	Session: Odd Sem 2024 Month from July to December 2024
Subject Name	**Theoretical Foundations of Computer Science**		
Credits	4	Contact Hours	3L +1T

Faculty (Names)	Coordinator(s)	Dr. Kavita Pandey (JIIT62), Dr. Himanshu Agrawal (JIIT128)
	Teacher(s) (Alphabetically)	JIIT62: Dr Amit Mishra, Dr Dharmveer Singh Rajpoot, Dr Kapil Madan, Dr Kavita Pandey, Dr Kirti Agarwal, Dr Tarun JIIT128: Dr Arti Jain, Dr Bansidhar Joshi, Dr Himanshu Agrawal, Dr Mukta Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
C211.1	Explain basic concepts of automata theory and formal languages	Understanding Level (C2)
C211.2	Apply the concepts of set theory, relations and functions in the context of various fields of computer science.	Apply Level (C3)
C211.3	Apply mathematical logic to solve problems.	Apply Level (C3)
C211.4	Evaluate Boolean functions and Analyze algebraic structure using the properties of Boolean algebra.	Analysis Level (C4)
C211.5	Inference formal statements to logical arguments and correlate these arguments to Boolean logic, truth tables, and rules of propositional and predicate calculus.	Analysis Level (C4)
C211.6	Analyze graph theory concepts for designing solutions to various computing problems.	Analysis Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Discrete Mathematics and Set Theory	Discrete Mathematics: A Brief Introduction, Set Notations, Cardinality of Sets; Some Standard Sets; Venn Diagrams; Operations on Sets; Principle of inclusion and exclusion; Disjoint Sets; Partition; Ordered Set; Cartesian Product of Sets; Algebra of Sets, Bit vector representation of sets.	4
2.	Relations	Domain and Range, Inverse of Relation, Composition of Relations, Different Types of Relations; Partial Order Relation; Hasse Diagram; Lattices; Pictorial or Graphical Representation of Relations; Matrix Representation of Relations; Closure of Relations.	6

3.	Functions and Recursion	Relations vs. functions, Types of functions, composition of functions, Induction, Recursively defined functions, Cardinality, Modeling using Recurrence Relation, Solution of Recurrence Relations, Linear Recurrence Relation with Constant Coefficients.	4
4.	Algebraic Structures	Binary Operations: semi-group, group; Subgroup: Cosets; Ring; Field; Boolean algebra; Binary Arithmetic.	4
5.	Logics	Proposition, Logical Operators, Tautology, Contradiction, Logical Equivalence, Tautological Implication, Converse, Inverse, and Contrapositive, Normal Forms, Arguments validity check, Predicates, Methods of Proof.	5
6.	Counting and Combinatorics	Basic Counting Principle, Permutations and Combinations, Binomial Coefficients, Pigeonhole principle.	3
7.	Graph Theory	Different Types of Graphs, Subgraphs, Operations on Graphs, Walk, Path, and Circuit; Connected Graph, Disconnected Graph, and Components; Euler and Hamiltonian Graphs; Planar Graph; Coloring of Graphs.	5
8.	Automata Theory	Regular Languages: Deterministic finite automata, Non-deterministic finite automata, Regular Expression; Context Free Languages; Turing machine.	11
Total number of Lectures			**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance (10), Assignments/Mini-project (15))
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Rosen, K. H., Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Tata McGraw-Hill, 2017.
2.	Liu, C. L., Elements of Discrete Mathematics, Tata McGraw-Hill, 2018.
3.	Linz, P, An Introduction To Formal Languages And Automata, Narosa Publishing House, 2013.
4.	Sipser, M., Introduction to the Theory of Computation, Second Edition, Thomson Course Technology, 2012.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI312	**Semester: Odd 24-25**	**Semester: III Session:** 2024-2025 **Month from** July'24 to Dec'24
Course Name	Database Systems & Web		
Credits	4	**Contact Hours**	**4 (3+1)**

Faculty (Names)	**Coordinator(s)**	Devpriya Soni, Kirti Jain
	Teacher(s) (Alphabetically)	Aarti Goel, AnubhutiRodaMohindra, Anuradha Surolia, Archana Purwar, DevpriyaSoni, Janardan K Verma,Kedar Nath Singh, Kirti Jain, Lalita Mishra, NeetuSardana, Neetu Singh,Shivenendra Singh, Sonal, Tanvi Gautam, VartikaPuri

COURSE OUTCOMES		**COGNITIVE LEVELS**
C212.1	Explain the basic concepts of Database systems and Web components.	Understand Level (Level II)
C212.2	Model the real-world systems using Entity Relationship Diagrams and convert the ER model into a relational logical schema using various mapping algorithms	Apply Level (Level III)
C212.3	Make use of SQL commands and relational algebraic expressions for query processing.	Apply Level (Level III)
C212.4	Simplify databases using normalization process based on identified keys and functional dependencies	Analyze Level (Level IV)
C212.5	Solve the atomicity, consistency, isolation, durability, transaction, and concurrency related issues of databases	Evaluate Level (Level V)
C212.6	Develop a simple web application with client and server-side scripting using Javascript and PHP and connect with a given relational database	Create Level (LevelVI)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Databases	Introduction to Databases, Physical Level of Data Storage, Structure of relational databases, Review of SQL Create, Insert, Update, Delete and Select Statements, Overview of NoSQL databases	4
2.	Web Architecture & Introduction	Motivation, characteristics and complexities of web applications, Basics, of Web Server and Application server, differences between web application and conventional software, architecture layers.	2
3.	Client Side Web Technology	SGML, HTML 5, DHTML, CSS, Java script	4
4.	Server Side Web Technology	PHP, Database Connectivity with PHP	4
5.	Database Design and ER Model	Entity type, Attributes, Relation types, Notations, Constraints, Extended ER Features	4
6.	Relational Model	SQL: Data Definition and Data Manipulation, Relational	9

	and Structured Query Language	Algebra	
7.	Procedural Language	PL/SQL: Stored Procedures, Functions, Cursors, Triggers	3
8.	Normalization	Data Dependencies, 2NF, 3NF, BCNF, building normalized databases	5
9.	Transaction Management	Transactions, Concurrency, Recovery, Security	7
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance:10, Assignments/Min-Project/Class Test/Quiz/Tutorial:15)
Total	**100**

Project Based Learning: Each student in a group of 3-4 will choose a real-life application area. To make a project, the students will analyze and define the need of database systems in terms of functional requirements. Each group will design the Entity Relationship diagram to understand the organizational structure of the application area and implement the database in MySQL. Each group will identify 15-20 typical queries and execute them. For handling the multiple records, they will implement cursors ad triggers. Student will design the webpage of the application area and connect with the database.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books:

1.	Henry F Korth, Abraham Silberschatz, S. Sudurshan, Database system concepts, 5th Edition, McGraw-Hill,2006
2.	RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 4th Edition, Pearson Education, 2006.

Reference Books:

1.	Ramakrishnan, Gehrke, Database Management Systems, Mcgraw-Hill, 3rdEdition,Addison-Wesley,2006.
2.	Thomas Connolly, Carolyn Begg, Database Systems-A Practical Approach to design, Implementation and Management, 3rd Edition, Addison-Wesley,2002.
3.	"PHP and MYSQL Manual" by Simon Stobart and Mike Vassileiou
4.	"PHP and MYSQL Web Development" by Luke Welling and Laura Thomson(Pearson Education)
5.	"An introduction to database systems" by Bipin C. Desai, West Publishing Company, College & School Division, 1990 - Computers - 820 pages
6.	Christopher J. Date, Database Design and Relational Theory: Normal Forms and All That Jazz, 2012.
7.	Rajiv Chopra, Database Management System (DBMS): A Practical Approach, 5th Edition, 2016, 682 pages.

Detailed Syllabus

Lab-wise Breakup

Course Code	15B17CI372	**Semester** Odd	**Semester** III **Session** 2024 -25 **Month from July** '24 **to Dec**'24
Course Name	Database System & Web Lab		
Credits	1	Contact Hours	2

Faculty (Names)	**Coordinator(s)**	Dhanalekshmi Gopinathan, Vartika Puri
	Teacher(s) (Alphabetically)	Anubhuti Mohindra, Anuja Arora, Anuradha Surolia, Arti, Deepika Varshney, Devpriya Soni, Diksha Chawla, Janardan Verma, Kirti Agarwal, Kirti Jain, Lalita Mishra, Neetu Sardana, Neetu Singh, Shariq, Sumeshwar Singh, Shivendra Singh, Tanvi Gautam, Vartika Puri

COURSE OUTCOMES		**COGNITIVE LEVELS**
C271.1	Develop web page using HTML, CSS with client-side scripting using JavaScript.	Apply (Level III)
C271.2	Make use of relational database and SQL commands for query processing.	Apply (Level III)
C271.3	Develop a simple web application with client and server-side scripting using JavaScript and PHP and connect to a given relational database.	Apply (Level III)
C271.4	Make use of PL/SQL commands including stored procedures, stored functions, cursors, triggers for query processing.	Apply (Level III)
C271.5	Design a Project based on database management system including a normalized database and a user interface.	Create (Level VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Client-Side Web Technology	1. Design web page using SGML, HTML 5, DHTML, CSS, Java script.	C271.1
2.	Server-Side Web Technology	1. Develop a web application with client and server-side scripting using JavaScript. 2. Develop a web application with client and server-side scripting using PHP. 3. Design web application with database connectivity. 4. Design web application with entering user data into database. 5. Design web application for user - database interaction through PHP.	C271.1, C271.3

3.	SQL	1. MySQL Create Insert, Update, Delete and Select Statements. 2. Simple Queries, Sorting Results (ORDER BY Clause) 3. SQL Aggregate Functions 4. Grouping Results (GROUP BY Clause) 5. Subqueries, ANY and ALL, Multi-Table Queries, EXISTS and NOT EXISTS 6. Combining Result Tables (UNION, INTERSECT, EXCEPT)	C271.2
4.	Pprocedural Language	1. Write PL/SQL program for storing data using procedures. 2. Write PL/SQL program for storing data using stored functions. 3. Write PL/SQL program for storing data using cursors and Triggers	C271.4
5.	Project	Students are expected to design a web application based on PHP or JavaScript which is connected with database to execute insert, update, retrieve and delete data queries.	C271.5

Evaluation Criteria

Components	**Maximum Marks**
Lab Test-1	20
Lab Test-2	20
Day-to-Day (Project, Lab Assessment, Attendance)	60
Total	100

Project based learning: Each student in a group of 3-4 will have to develop a project based on different real-world problems. Students must study the web and database related technologies before finalizing the objectives. For handling the multiple records, they will implement cursors and triggers. Student will design the webpage of the application area and connect with the database. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books	
1.	Henry F Korth, Abraham Silberschatz, S. Sudurshan, Database system concepts, 7th Edition, McGraw-Hill,2019
2.	RamezElmasri ,Shamkant B. Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education, 2015.
3.	Ramakrishnan, Gehrke, Database Management Systems, Mcgraw-Hill, 3rdEdition,Addison-Wesley,2014.
Reference Books	
1.	Thomas Connolly, Carolyn Begg, Database Systems-A Practical Approach to design, Implementation and Management, 6rd Edition, Addison-Wesley,2015.
2.	"PHP and MYSQL Manual" by Simon Stobart and Mike Vassileiou

3.	“PHP and MYSQL Web Development” by Luke Welling and Laura Thomson(Pearson Education), 5th Edition, 2016.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11HS211	**Semester :ODD (specify Odd/Even)**	**Semester** :III **Session 2024-25** Month from: July-December
Course Name	Economics		
Credits	03	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr.Amba Agarwal(Sec 128) & Dr. Amandeep Kaur(Sec 62)
	Teacher(s) (Alphabetically)	Dr.Anshu Banwari Dr. Amandeep Kaur Dr. Amba Aggarwal Dr. Kanupriya Misra Bakhru Dr. Manas Behera Dr. Mukta Mani Dr. Neha Singh Dr. Vandana Sehgal Dr. Praveen Sharma Dr.Purwa Srivastava Dr. Sakshi Varshney

COURSE OUTCOMES		**COGNITIVE LEVELS**
C206.1	*Understand* the fundamental concepts of micro and macro economics.	Understanding Level(C2)
C206.2	*Apply* the concepts of opportunity cost, national income accounting and various business forecasting methods.	Applying Level (C3)
C206.3	*Analyze* the concepts of demand, supply, market equilibrium, consumer choices and production in micro-economic decision making.	Analyzing Level (C4)
C206.4	*Evaluate* the different market structures and their implications on the behavior of the firm.	Evaluating Level(C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Economics Definition, Basic economic problems, Resource constraints and welfare maximization. Micro and Macro economics. Production Possibility Curve. Circular flow of economic activities.	2
2.	Basics of Demand, Supply and Equilibrium	Demand side and supply side of the market. Factors affecting demand & supply. Elasticity of demand & supply – price, income and cross-price elasticity. Market equilibrium price.	6
3.	Theory of Consumer Choice	Theory of Utility and consumer's equilibrium. Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.	2
4.	Demand forecasting	Regression Technique Time-series Smoothing Techniques: Exponential, Moving Averages Method	4

5.	Production theory and analysis	Production function. Isoquants, Isocostlines, Optimal combination of inputs. Stages of production, Law of returns, Return to scale.	2
6.	Cost Theory and Analysis	Nature and types of cost. Cost functions- short run and long run Economies and diseconomies of scale	2
7.	Market Structure	Market structure and degree of competition Perfect competition Monopoly Monopolistic competition Oligopoly	6
8	National Income Accounting	Overview of Macroeconomics, Basic concepts of National Income Accounting,	2
9	Macro Economics Issues	Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.	2
		Total number of Lectures	28 (lectures)

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz+ Project+ Class Participation)
Total	**100**

Project based learning: Students have to form a group (maximum 5 students in each group) and have to do an economic analysis on the topic assigned. An economic impact analysis assesses the impact of an event on the economy in a particular area. It generally measures the effect on revenue, profits, wages and jobs. The knowledge gained in conducting economic analysis will enhance student's decision-making skills.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	H.C. Petersen, W.C. Lewis, *Managerial Economics*, 4th ed., Pearson Education 2001.
2.	D. Salvatore, Managerial Economics in a Global Economy, 8th ed., Oxford University Press, 2015.
3.	S. Damodaran, Managerial Economics, 2 nd ed., Oxford University Press, 2010.
4.	M. Hirschey, Managerial Economics, 12th ed., Cengage India, 2013.
5.	P.A. Samuelson, W.D. Nordhaus, S. Nordhaus,Economics,18th ed., Tata Mc-Graw Hill, 2006.
6.	S.K. Misra& V. K. Puri, Indian Economy, 38th ed., Himalaya Publishing House, 2020.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B11CS211	**Semester** Odd **(specify Odd/Even)**	**Semester** 3rd **Session** 2024 -2025 **Month from** July to December
Course Name	Data Structures and Algorithms		
Credits	3-1-2	**Contact Hours**	4hrs

Faculty (Names)	**Coordinator(s)**	Ms. Astha Singh
	Teacher(s) (Alphabetically)	Ms. Astha Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C210.1	Explain the complexity of different algorithms.	Understand [Level 2]
C210.2	Implement various linear data structures and their related operations.	Apply [Level 3]
C210.3	Implement various non- linear data structures and their related operations.	Apply [Level 3]
C210.4	Apply appropriate data structure/ algorithmic design technique to solve a given problem.	Apply [Level 3]
C210.5	Analyze the performance of relevant data structure and algorithm for a given problem.	Analyze [Level 4]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to DS and Algorithms	Fundamentals of Data Structures, Memory Allocation, Abstract Data types, Linear and non-linear DS. Introduction to problem solving approach; Growth of functions and solving recurrences; Notations- Big O, Big Omega, Big Theta;	4
2.	Linear Data Structures	Implementation of Arrays: Storage, traversal, Searching (Linear) and Sorting (selection, bubble, insertion) . Implementation of Linked List: Singly, Doubly, Circular. Implementation of Stack and Queue.	7
3.	Non-linear DS: Trees and related algorithms	Insertion, deletion and search operations in Binary Tree, BST, AVL. Priority queue using binary heap. Fundamentals of Graphs: Adjacency matrix and list; traversal (DFS/BFS) .	9
4.	Algorithm Design Technique: Divide and Conquer	Fundamentals of Divide and Conquer (D&C) approach using Binary search, Median Search, Quick sort, and Merge sort and Closest pair, etc.	3
5.	Algorithm Design Technique: Greedy Algorithms	Fundamentals of greedy based solution approach using Minimum Spanning Trees (Prim's and Kruskal algorithms); Shortest Path using Dijkastra algorithm; Fractional Knapsack; Coinage problemetc	4

6.	Algorithm Design Technique: Backtracking Algorithms	Fundamentals of backtracking based solution approach using N queen; M-coloring problem; Hamiltonian Cycle detection; Max flow in Network.	5
7.	Algorithm Design Technique: Dynamic Programming	Fundamentals of Dynamic programming based solution approach; 0/1 Knapsack ,Coinage problem; Longest common subsequence; Longest increasing sequence; Shortest path using Floyd Warshall; Matrix chain multiplication etc.	6
8.	String Algorithms	Naïve String Matching, Finite Automata Matcher, Rabin Karp matching algorithm, Knuth Morris Pratt. Tries.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Project based learning (10) Assignments (5))
Total	**100**

Project based learning: Every student works in a group (2-3 students) for creating mini-project using C++ language and applications of the alogorithms. Algorithms are used in every part of computer science as they form application's or a project's backbone. C++ language provides a platform for the students to analyze, develop and debug programs and helps in their employability as software organizations prefer candidates having prior knowledge ofC++language andalogorithms.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Leiserson, Charles E.., Stein, Clifford., Rivest, Ronald L.., Cormen, Thomas H.. Introduction to Algorithms, Fourth Edition. United States: MIT Press, 2022.
2.	Anggoro, Wisnu. C++ Data Structures and Algorithms: Learn how to Write Efficient Code to Build Scalable and Robust Applications in C++. India: Packt Publishing, 2018.
3.	Carey, John., Doshi, Shreyans., Rajan, Payas. C++ Data Structures and Algorithm Design Principles: Leverage the Power of Modern C++ to Build Robust and Scalable Applications. United Kingdom: Packt Publishing, 2019.
4.	Drozdek, Adam. Data structures and algorithms in C++. United States: Cengage Learning, 2005.

Reference Books and Material

5.	Alfred V. Aho, J.E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983
6.	Weiss, Data Structures and Algorithm Analysis in C, Benjamin and Cummings Pub., 1994
7.	Fundamanetal of Data Structures in C++, Horobitz and Sahni and Mehta, 2009, Galgotia
8.	Theory and Problems of Data Structures with C++, Shaum's outline, McGraw-hill, 2000
9.	Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 1978
10.	ACM Transactions on Algorithms (TALG)

Detailed Syllabus

Subject Code	18B15CS211	**Semester ODD**	**Semester: 3rd Semester Session:** 2024-2025 **Month from July to December**
Subject Name	Data Structures and Algorithms Lab		
Credits	**2**	**Contact Hours**	**4**

Faculty (Names)	**Coordinator(s)**	Ms. Neha
	Teacher(s) (Alphabetically)	Dr. Astha Singh, Ms. Mayuri, Ms. Neha,

COs	Description	Cognitive Level (Bloom Taxonomy)
C274.1	Demonstrate the use of basic data structure and algorithm design such as Linked lists, Stacks, Queues, and others, for various applications.	Understanding Level (C2)
C274.2	Interpret the complexity of algorithms for given problems.	Understanding Level (C2)
C274.3	Apply Searching, Sorting, and Trees and use their properties for abstractions and defining modules for implementing functionalities.	Apply Level (C3)
C274.4	Examine case-study specific application of Heaps, Graphs, and Hashing methods.	Apply Level (C3)
C274.5	Model algorithmic solutions for small real-life problems using Backtracking, Greedy algorithm and Dynamic programming, Branch and Bound, and others	Apply Level (C3)

Module No.	Subtitle of the Module	Topics in the module	No. of LAB
1.	Linear DS: Arrays and related algorithms	Arrays: Storage, traversal, Searching (Linear, Binary, Median, Interpolation), Sorting (Selection, Insertion, Bubble, Merge, Quick), Applications and Manipulations.	**4**
2.	Analysis of Algorithms	Introduction to problem solving approach; Growth ofFunctions; determine execution time	**1**
3.	Linear DS: Stacks & Queues and related algorithms	Stacks and Queues using arrays and linked list, Circular Queue, Priority Queues using Binary Heap, Stack & Queue based applications.	**8**
4.	Non-linear DS: Trees and related algorithms	Insertion, deletion and search operations in Binary Tree, BST, AVL, B Tree, B+ Tree. Applications of trees.	**6**
5.	Non-linear DS: Graphs and related algorithms	Graphs storage and basic algorithms, e.g., traversal (DFS/BFS), minimum spanning tree (Prims/Kruskal), Shortest paths in weighted and unweighted graphs.	**4**

		Minimum Spanning Trees (Prim's and Kruskal algorithms); Shortest Path using Dijkstra algorithm; Shortest path using Floyd Warshall;	
6.	Algorithm Design Techniques: Divide and Conquer, Greedy Algorithms, Backtracking Algorithms, Dynamic Programming.	Strassen's matrix multiplication; and Closest pair, etc. Fractional and 0/1 Knapsack; Coinage problem; Job scheduling; Graph coloring; N queen; M-coloring problem; Hamiltonian Cycle detection; Travelling salesman problem; Coinage problem; Longest common subsequence; Longest increasing sequence;	**3**
7.	Project	Students are expected to design an application based by applying concepts of data structure and algorithms.	**2**
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
Evaluation 1	15
Lab Test 1	20
Evaluation 2	15
Lab Test 2	20
TA	30 (Attendance (15), Project (15))
Total	**100**

Project Based Learning: Student will make an application by applying the concepts of data structure and algorithms (either individual or in a group of 2-3students) covered as part of this course. Student will be required to develop a project by selecting appropriate algorithm for the application through analyzing the complexity of the algorithms. Building an application by choosing best data structure and algorithm reduces the space and time required to execute the application, while handling the various facets of data structure and algorithm will give students a hands-on experience of working in the area of application development. The knowledge gained will enhance their employability in the IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Leiserson, Charles E.., Stein, Clifford., Rivest, Ronald L.., Cormen, Thomas H.. Introduction to Algorithms, Fourth Edition. United States: MIT Press, 2022.
2.	Anggoro, Wisnu. C++ Data Structures and Algorithms: Learn how to Write Efficient Code to Build Scalable and Robust Applications in C++. India: Packt Publishing, 2018.
3	Carey, John., Doshi, Shreyans., Rajan, Payas. C++ Data Structures and Algorithm Design Principles: Leverage the Power of Modern C++ to Build Robust and Scalable Applications. United Kingdom: Packt Publishing, 2019.
4	Drozdek, Adam. Data structures and algorithms in C++. United States: Cengage Learning, 2005.

Reference Books and Material

1.	Alfred V. Aho, J.E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983
2.	Weiss, Data Structures and Algorithm Analysis in C, Benjamin and Cummings Pub., 1994
3.	Fundamental of Data Structures in C++, Horobitz and Sahni and Mehta, 2009, Galgotia
4.	Theory and Problems of Data Structures with C++, Shaum's outline, McGraw-hill, 2000

5.	Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 1978
6.	ACM Transactions on Algorithms (TALG), 2022

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B11EC211	**Semester** Odd	**Semester** 3rd **Session** 2024 -2025 **Month from** July to December
Course Name	Electrical Science-2		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Pimmy Gandotra, Abhijeet Upadhya
	Teacher(s) (Alphabetically)	Atul Kumar, Astha Sharma, Amrita Kaul, Aanchal Agarwal, Bhartendu Chaturvedi, Bhuvaneshwari S, Gaurav Verma, Jyoti Deshwal Yadav, Megha Agarwal, Manika Jha, Nidhi Tewari , Ravi, Rishibrind Upadhyay, Sajai Vir Singh, Shradha Saxena, Saurabh Chaturvedi, Vaishali Sharma, Vivek K. Dwivedi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C203.1	Remember the complete response of the first order and second order circuits with energy storage and/or non-storage elements.	Remembering Level (C1)
C203.2	Understand two-port network parameters and operational amplifier, first-order & second-order filters.	Understanding Level (C2)
C203.3	Applying the concept of semiconductors in PN junction diode, Zener diode and its various applications.	Applying Level (C3)
C203.4	Analyzing the characteristics and operation of bipolar junction transistor (BJT) and its biasing, stability aspects.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Transient Analysis	First-order RC/RL circuit analysis, sequential switching, differential equation approach for solving 1st and 2nd order network containing DC and Non constant source.	10
2.	Two Port Network Parameters	Introduction to Z, Y, h and Transmission two-port parameters and their conversions.	5
3.	Operational Amplifier and Filters	Introduction to Operational Amplifier and its applications, First-order and Second-order (Low Pass, High Pass, Band pass and Band Stop) Filters.	5

4.	Introduction to Semiconductor	Semiconductor Physics-Energy Band Model, Types of semiconductors, Drift Current, conductivity equations and Hall Effect.	6
5.	Diodes & it's Applications	P-N Junction diode, Biasing the PN Junction diode, Current–Voltage Characteristics of a P-N Junction, Half Wave Rectifier &Full Wave Rectifier, Clipper &Clamper Circuits, Zener Diode and its application as voltage regulator	8
6.	Introduction to Bipolar Junction Transistor	Transistor Construction and Basic Transistor Operation, Transistor Characteristics in different configuration (CE, CB, CC), Transistor Biasing & Stability.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project Based Learning: Students will learn about the transient responses of the first/second order circuits, which is the utmost requirement for electronic circuit design. Also, the students with the knowledge of OP-AMP and filters, can design and analyse the circuits for the signal processing applications.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R. C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 9thed, John Wiley & Sons, 2013.
2.	Charles K. Alexander, Matthew N.O. Sadiku, "Fundamentals of Electric Circuits", 6th Edition, Tata McGraw Hill, 2019.
3.	Abhijit Chakrabarti, Circuit Theory Analysis and Synthesis, 7thed, Dhanpat Rai &Co. 2018.
4.	Robert L.Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 11thed, Prentice Hall of India, 2014.
5.	Jacob Millman, Millman's Electronic Devices and Circuits (SIE), 4thed, McGraw Hill Education, 2015.

Course Description
Lecture wise Breakup

Course Code	15B17EC271	**Semester :** Odd	**Semester :** III **Session :** 2024-2025 **Month :** July- December
Course Name	Electrical Science Lab-2		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Atul Kumar, K. Nisha
	Teacher(s)	Abhijeet Upadhya, Bajrang Bansal, Bhartendu Chaturvedi, Megha Agarwal, Monika, Neetu Joshi, Pimmi Gandotra, Prabhanshu, Ravi Kumar, Rishibrind Upadhaya, Sajai Vir Singh, Saurabh Chaturvedi, Shraddha Saxena, Smriti Bhatnagar, Vishal N Saxena

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Recall the basic concepts and terms about different equipment like CRO, function generator, multi meter, and components like resistor, capacitor, inductor, breadboard, diode, and transistor.	Remembering Level (C1)
C204.2	Illustrate the transient analysis of first order series RC circuits.	Understanding Level (C2)
C204.3	Experiment with different types of two-port network models and Op-amp configurations.	Applying Level (C3)
C204.4	Examine the characteristics of PN junction and Zener diodes and analyze their applications.	Analyzing Level (C4)
C204.5	Explain the characteristics of a BJT in different configurations like common emitter and common base.	Evaluating Level (C5)

Module No.	**Title of the Module**	**List of Experiments**	**COs**
1.	Introduction: Basic equipment & first order passive circuits	To study the basic concepts and terms about different equipment like CRO, function generator, Regulated D.C. power supply and multimeter.	C204.1
		To study the transient response of a series RC circuit and the time constant concept using pulse waveforms.	C204.2
2.	Two port resistive networks	To determine the Z-parameters of a two- port resistive network.	C204.3
		To determine the h-parameters of a two-port resistive network.	C204.3
3.	Operational amplifier and its applications	To realize inverting and non inverting configurations using Op-Amp IC 741 amplifier.	C204.3
		To realize an adder and subtractor circuits using Op-Amp IC 741 amplifier.	C204.3
4.	PN junction and Zener diodes	To study the forward and reverse bias (volt-ampere) characteristics of a simple p-n junction diode. Also determine the forward resistance of the diode.	C204.4
		To study the forward and reverse bias volt-ampere characteristics of a Zener diode. Also determine the breakdown voltage, static and dynamic resistances.	C204.4

5.	Diode applications	To observe the output waveform of half/full wave rectifiers and calculate its ripple factor and efficiency.	C204.4
		Realization of desired wave shapes using clipper and clamper circuits.	C204.4
		To study Zener voltage regulator and calculate percentage regulation for line regulation and load regulation.	C204.4
6.	Bipolar Junction Transistor	To plot input characteristics of a common emitter npn BJT.	C204.5
		To plot output characteristics of a common emitter npn BJT.	C204.5
		To plot input characteristic of a BJT in Common Base Configuration.	C204.5
		To plot output characteristic of a BJT in Common Base Configuration.	C204.5
7.	First order filters	To plot frequency and phase response of First order low pass and high pass filters.	C204.5

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Attendance and D2D	60 (15+45)
Total	**100**

Project Based Learning: Students will learn about the transient response of first and second order passive circuits. Also, students will learn about Op-amp and its applications like adder and subtractor circuits. This course also gives the understanding of semiconductor diode and Bipolar Junction Transistor. These concepts are required for Electronic circuits design.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R.C.Dorf, A. Svoboda, "Introduction to Electric Circuits",9th ed, John Wiley & Sons, 2013.
2.	D. Roy Choudhary and Shail B. Jain, "Linear Integrated Circuit," 2nd Edition, NAILP, 2003
3.	A.S .Sedra & K.C.Smith, Microelectronic Circuits Theory and Application, 6th Edition, Oxford University Press, 2015(Text Book)